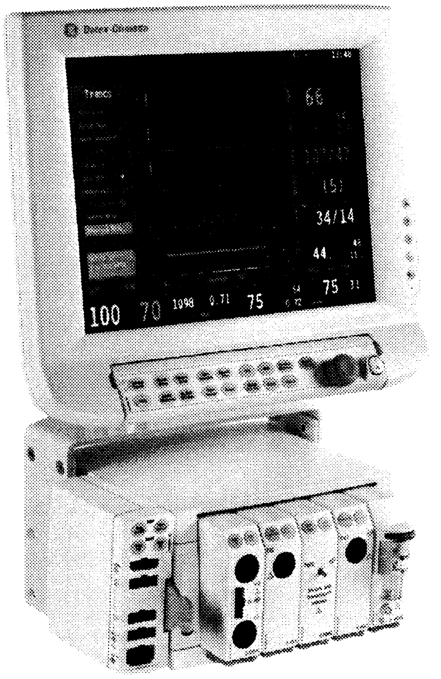
Datex-Ohmeda

S/5™ Anesthesia Monitor and Critical Care Monitor

Technical Reference Manual



All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

M1021563
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Intended purpose (Indications for use)

The Datex-Ohmeda S/5 Anesthesia Monitor with L-ANE05 or L-ANE05A software is intended for multiparameter patient monitoring with optional patient care documentation.

The S/5 Anesthesia Monitor with L-ANE05 and L-ANE05A software is indicated for monitoring of hemodynamic (including arrhythmia and ST-segment analysis), respiratory, ventilatory, gastrointestinal/regional perfusion, Bispectral index (BIS), Entropy (State Entropy and Response Entropy) and neurophysiological status of all hospital patients.

The S/5 Anesthesia Monitor with L-ANE05 and L-ANE05A software when using BIS is for monitoring the state of the brain by data acquisition and processing of electroencephalograph signals and may be used as an aid in monitoring the effects of certain anesthetic agents.

The S/5 Anesthesia Monitor with L-ANE05 and L-ANE05A software is also indicated for documenting patient care related information.

The S/5 Anesthesia Monitor with L-ANE05 and L-ANE05A software is indicated for use by qualified medical personnel only.

The Datex-Ohmeda S/5 Critical Care Monitor with L-ICU05 or L-ICU05A software is intended for multiparameter patient monitoring.

The S/5 Critical Care Monitor with L-ICU05 and L-ICU05A software is indicated for monitoring of hemodynamic (including arrhythmia and ST-segment analysis), respiratory, ventilatory, gastrointestinal/regional perfusion, Bispectral index (BIS) and neurophysiological status of all hospital patients.

The S/5 Critical Care Monitor with L-ICU05 and L-ICU05A software when using BIS is for monitoring the state of the brain by data acquisition and processing of electroencephalograph signals and may be used as an aid in monitoring the effects of certain anesthetic agents.

The S/5 Critical Care Monitor with L-ICU05 and L-ICU05A software is indicated for use by qualified medical personnel only.

Classifications

In accordance with IEC 60601-1

Class I and internally powered equipment - the type of protection against electric shock.

Type BF or CF equipment. The degree of protection against electric shock is indicated by a symbol on each parameter module.

Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

Continuous operation according to the mode of operation.

In accordance with IEC 60529

With F-CU8 Central Unit: IPX0 - the degree of protection against harmful ingress of water.

With F-CU5(P) Central Unit: IPX1 - the degree of protection against harmful ingress of water.

In accordance with EU Medical Device Directive

The Datex-Ohmeda S/5 Anesthesia Monitor is classified as IIb.

The Datex-Ohmeda S/5 Critical Care Monitor is classified as IIb.

In accordance with CISPR 11:

Group 1, Class B (F-CU5(P), F-CPU and N-AC: Class A)

- Group 1 contains all ISM (industrial, scientific and medical) equipment in which there is intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.
- Class B equipment is suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

- Class A equipment is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Responsibility of the manufacturer

GE Healthcare Finland Oy (GE) is responsible for the safety, reliability and performance of the product only if:

- modifications, service and repairs are carried out by personnel authorized by GE.
- the electrical installation of the room complies with appropriate requirements.
- the equipment is used in accordance with the User's Guide and serviced and maintained in accordance with the Technical Reference Manual.

Datex-Ohmeda S/5^{TM} Anesthesia and Critical Care Monitors

Technical Reference Manual, Order code: M1021563

Part I, General Service Guide

Document No.	Updated	Description	
M1027807		Introduction, System description, Installation, Interfacing, Functional check, General troubleshooting	**1**
M1027808		Planned Maintenance Instructions	**2**

Part II, Product Service Guide

Document No.	Updated	Description	
M1027809		AM, CCM Service Menu	**1**
M1027810		8-Module Frame, F-CU8	**2**
M1027811		5-Module Frame, F-CU5(P)	**3**
M1027812		CPU Board, B-CPU5	**4**
M1027813		UPINET Board, B-UPI4NET	**5**
M1023412		Displays and Display Controller Boards	**6**
M1027814		Command Boards and Bars	**7**
M1027815		Interface Board, B-INT	**8**
M1027816		Extension Frame, F-EXT, Extension Module, M-EXT	**9**
M10 39372		AM, CCM Spare Parts	**10**

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About this manual

Notes to the reader

This Technical Reference Manual is intended for service personnel and engineers who will service and maintain Datex-Ohmeda S/5 Anesthesia and Critical Care Monitors

- The order code for the entire printed manual is M1021563. The manual includes Technical Reference Manual Slots and every slot has an individual document number. M1027807 is the document number of this first slot.
- Part I gives the reader an overview of the S/5 Anesthesia Monitor and S/5 Critical Care Monitor. It contains the information needed to install, interface and troubleshoot the monitors. Instructions for functional check and planned maintenance are also included. Read the manual through and make sure that you understand the procedures described before the installation of the monitor. To avoid risks concerning safety or health, strictly observe the warning indications. If you need any assistance concerning the installation, please do not hesitate to contact your authorized distributor.
- Part II contains detailed descriptions of each component of the S/5 AM, CCM, such as frame unit and displays. Service check for each product is included in these slots. Service Menu slot contains all the service menus and Spare Parts slot all the spare parts information for this monitor.

For information of parameter modules, Remote Controller and Device Interfacing Solution refer to the S/5 E-Modules Technical Reference Manual. Service check for each of these products is included in these slots.

The manufacturer reserves the right to change product specifications without prior notice. Although the information in this manual is believed to be accurate and reliable, the manufacturer assumes no responsibility for its use.

GE Healthcare Finland Oy (GE) assumes no responsibility for the use or reliability of its software in equipment that is not furnished by GE.

Related documentation

S/5 Modules

S/5 E-Modules Technical Reference Manual
S/5 M-Modules Technical Reference Manual

Other devices closely related to the S/5 Anesthesia Monitor:
iCentral, User's Reference Manual
S/5 Arrhythmia Workstation User's Reference Manual

S/5 Anesthesia Monitor

Instructions for daily use, clinical aspects and basic methods of measurement:
S/5 Anesthesia Monitor, User's Guide
S/5 Anesthesia Monitor, User's Reference Manual

S/5 Critical Care Monitor

Instructions for daily use, clinical aspects and basic methods of measurement:
S/5 Critical Care Monitor, User's Guide
S/5 Critical Care Monitor, User's Reference Manual

Conventions used

To help you find and interpret information easily, the manual uses consistent text formats:

✍	Sign the check form after performing the procedure.
Hard Keys	Names of the hard keys on the Remote Controller, Command Bar and modules are written in the following way: **Others.**
Hard Keys	***Menu Items***Software terms that identify window parts or menu items are written in bold italic: ***ECG Setup.*** Menu access is described from top to bottom. For example, the selection of the **Monitor Setup** hard key, the ***Screen 1 Setup*** menu item and the ***Waveform Fields*** menu item would be shown as **Monitor Setup** - ***Screen 1 Setup*** - ***Waveform Fields***.
'Messages'	Messages (alarm messages, informative messages) displayed on the screen are written inside single quotes: 'Please wait'.
"Sections"	When referring to different sections in this manual or to other manuals, manual names and section names are enclosed in double quotes: See section "Cleaning and care. " Please refer to "iCentral User's Reference Manual: Alarms. "
Hypertext links	Hypertext links on PDF versions are written in blue color.
WARNING	Warnings are written in the following way:
WARNING	**This is a WARNING.**
CAUTION	Cautions are written in the following way:
CAUTION	This is a CAUTION.
NOTE	Notes are written in following way:
	NOTE: This is a NOTE.

In this manual, the word "select" means choosing and confirming.

Illustrations and names

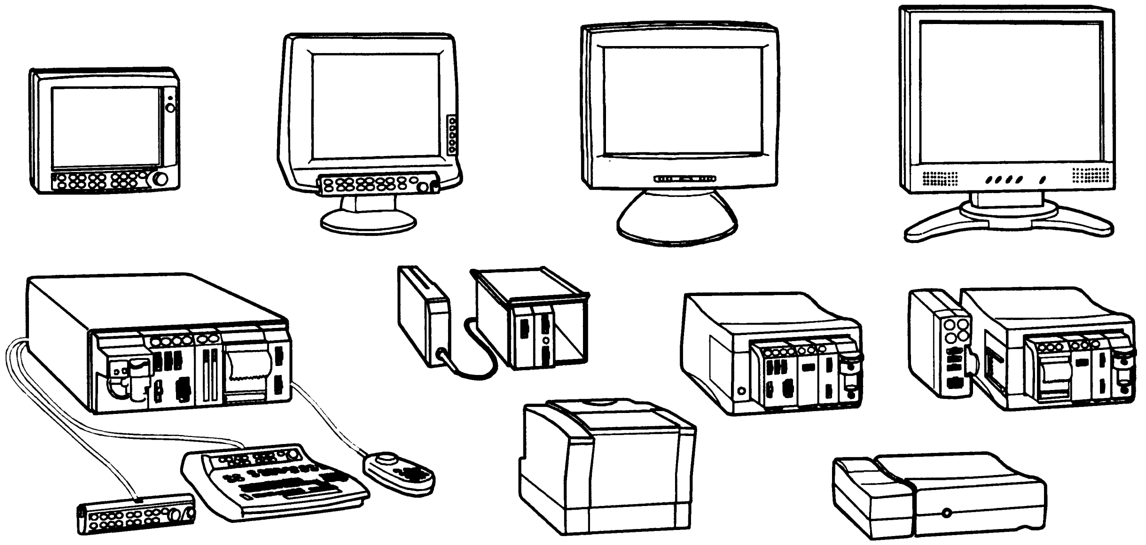
All illustrations in this manual are only examples, and may not necessarily reflect your system settings or data displayed in your system. If a particular selection is not available in your system, the selection is shown grayed.

1 Introduction

The Datex-Ohmeda S/5 Anesthesia Monitor is a modular multiparameter patient monitor used during anesthesia in operating rooms.

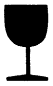
The Datex-Ohmeda S/5 Critical Care Monitor provides full patient profile throughout the care period.

The modular design makes the system flexible and easy to upgrade. In addition to parameter changes, the modularity includes an easy upgrade to anesthesia record keeping, monitor networking and interfacing with other external devices.

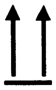


1.1 Symbols

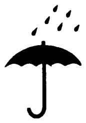
1.1.1 Symbols on transport packaging



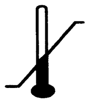
The contents of the transport package are fragile and must be handled with care.



Indicates the correct upright position of the transport package.

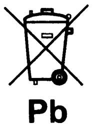


The transport package must be kept in a dry environment.

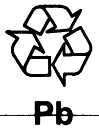


Indicates the temperature limitations within which the transport package should be stored.

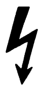
1.1.2 Symbols on equipment



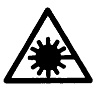
The battery contains lead acid, and in the event of disposal must be separated from other waste according to local regulations.



This battery contains lead and can be recycled.

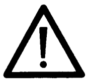


Dangerous voltage.



When using the ARK Barcode Reader, N-SCAN, do not stare into beam. The N-SCAN Barcode Reader is a Class 2 laser product.

1.1.3 Equipment safety symbols



- Attention, consult accompanying documents.
- When displayed next to the O2 value, indicates that the FiO2 low alarm limit is set below 21 %.
- When displayed next to the HR value, indicates that there is a risk that the monitor counts

  * pacemaker spikes because the pacer is set on R.
  * T-waves because a wide QRS is selected.
- On the 15" display, D-VMC15, indicates that the display should be supplied from the mains outlet (or from the Central Unit, F-CU8 Rev.03 - 09).
- On the 15" display, D-VNC15, indicates that the display must be supplied from the mains outlet via an appropriate additional separating transformer (or from the Central Unit, F-CU8 Rev.03 - 09).
- On the 15" LCD display, D-LCC15, indicates that the display must only be used together with the original type of D-LCC15 power adapter. The display should be supplied from the mains outlet (or from the Central Unit, F-CU8 Rev.03 - 09).
- On the 17" display, D-LCC17 indicates that the display must be used only together with the original D-LCC17 power adapter.
- On the 17" display, D-VHC17 rev.00-01, indicates that the display must only be supplied from the mains outlet, not from the Central Unit, F-CU8.
- On the 17" display, D-VHC17 rev. 02 or higher, indicates that the display should be supplied from the mains outlet via an appropriate additional separating transformer (or from the Central Unit, F-CU8 Rev.03 - 09).
- On the 19" display, D-LCC19, indicates that the display must only be supplied from the mains outlet via an appropriate additional separating transformer and the original D-LCC19 power adapter, not from the Central Unit, F-CU8.
- On the 21" display, D-VSC21, indicates that the display must only be supplied from the mains outlet via an appropriate additional separating transformer, not from the Central Unit, F-CU8.
- On the Interface Module E-INT, M-INT, indicates that it is for connecting external devices. Do not connect patient cables to the module.
- On the E-TONO, M-TONO module indicates that the module should only be used with Tonometrics catheters.
- On the E-miniC module indicates that airway gases should be calibrated every six months in normal use and every two months in continuous use.
- BIS: On the Aspect DSC indicates that the converter must not be opened for any reason or autoclaved.
- On the E-PRESTN, E-PRETN, E-RESTN, E-PSM, E-PSMP, E-P, E-PP, E-PT, E-COP and E-COPSv module indicates that protection against cardiac defibrillator discharge is due in part to the accessories for pulse oximetry (SpO2), temperature (T) and invasive pressure (P) measurement.

- On the E-NMT, M-NMT module indicates the following warnings:

  * Do not place the NMT stimulating electrodes on the patient's chest.

  * Always stop the NMT measurement before handling the stimulating electrodes.

  * Never subject a patient with an implanted electronic device to electrical stimulation without consulting a medical specialist first.
- On the rear or bottom panel this symbol indicates the following warnings and cautions:

  * Electric shock hazard. Do not open the cover or the back. Refer servicing to qualified service personnel.

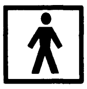
  * For continued protection against fire hazard, replace the fuse only with one of the same type and rating.

  * Disconnect from the power supply before servicing.

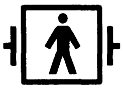
  * Do not use the monitor without manufacturer approved mounting attached.
- On the rear panel of the power unit (N-AC) this symbol indicates the following warnings and cautions:

  * Electric shock hazard. Do not open the cover. Refer servicing to qualified service personnel.

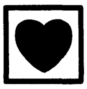
  * Does not contain field replaceable fuses.



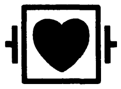
Type BF (IEC 60601-1) protection against electrical shock.



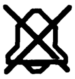
Type BF (IEC 60601-1) defibrillator-proof protection against electric shock.



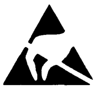
Type CF (IEC 60601-1) protection against electric shock.



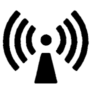
Type CF (IEC 60601-1) defibrillator-proof protection against electric shock.



When displayed in the upper left corner of the screen, indicates that the alarms are silenced. When displayed in the menu or digit fields, indicates that the alarm source has been turned off or alarm does not meet the alarm-specific activation criteria.

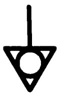
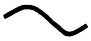
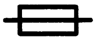
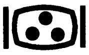
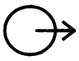
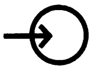
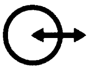
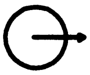
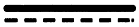
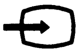
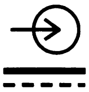
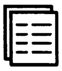
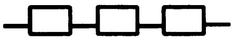


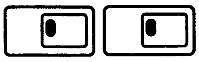
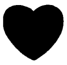
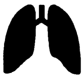
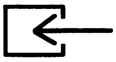
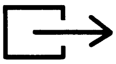
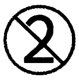
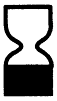
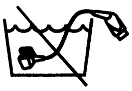
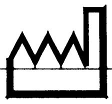
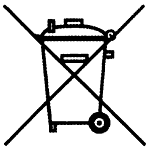
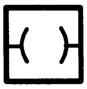
ESD warning symbol for electrostatic sensitive devices. Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see "ESD precautionary procedures" in the User's Reference Manual.



Symbol for non-ionizing electromagnetic radiation. Interference may occur in the vicinity of equipment marked with this symbol.

1.1.4 Other symbols

	Equipotentiality. Monitor can be connected to potential equalization conductor.
	Alternating current
	Fuse. Replace the fuse only with one of the same type and rating.
SN, S/N	Serial Number
	Connector for color display
	Signal/power output
	Signal/power input
	Signal/power input/output
 Defib. Sync.	Connector for defibrillator synchronization
DIS	Connector for the S/5 Device Interfacing Solution, DIS
	Power input
	Signal input
	Power input
	Submenu. Selecting an alternative marked with this symbol in a menu opens a new menu.
	The monitor is connected to the iNetwork (LAN).

	Data Card (green) and/or Menu Card (white) is inserted.
	A blinking heart next to the heart rate or pulse rate value indicates the beats detected.
	A lung next to the respiration rate value indicates that respiration rate is calculated from the impedance respiration measurement.
	Gas inlet
	Gas outlet
	Do not reuse.
	Use by. Indicates the last use day.
	Do not immerse the sensor in liquids.
IPX class:	Degree of protection against harmful ingress of water as detailed in the IEC 60529:
IPX0	- Ordinary equipment
	Date of manufacture
	This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.
	Ethernet connector

1.2 Safety

The following list contains general warnings and cautions you should know before installing, maintaining or servicing the system. Warnings and cautions specific to the use of the system can be found in the User's Guide and User's Reference Manual.

1.2.1 Safety precautions

Warnings

WARNING **A WARNING indicates a situation in which the user or the patient may be in danger of injury or death.**

Power connection

- Use only hospital-grade grounded power outlets and power cord. Do not remove the grounding pin from the power plug.
- Use only an intact power cord. Replace the power cord if it is cracked, frayed, broken or otherwise damaged.
- Do not apply tension to the power cord otherwise the cord may get damaged.
- Do not use extension cords or adapters of any type.
- Before starting to use the system, ensure that the whole combination complies with the international standard IEC 60601-1-1 and with the requirements of the local authorities.

Installation

- Keep the monitor horizontal when the Compact Airway Module is used. Tilting the monitor may cause erroneous results in the Compact Airway Module's readings and damage the module.
- The monitor or its components should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor and its components should be observed to verify normal operation in the configuration in which it will be used.
- Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see section "ESD precautionary procedures."
- After transferring or reinstalling the monitor, always check that it is properly connected and all parts are securely attached. Pay special attention to this in case of stacked mounting.

Laser radiation

- When using the ARK Barcode Reader, N-SCAN, do not stare into the beam. The N-SCAN is a Class 2 laser product.

External connection

- Do not connect any external devices to the monitor other than those specified.

Fuse replacement

- Replace a fuse only with one of the same type and rating.

Explosion hazard

- Do not use the monitor in the presence of flammable anesthetics.

Patient safety

- Do not perform any testing or maintenance on the monitor while it is being used on a patient.
- PACEMAKER PATIENTS: The impedance respiration measurement may cause rate changes in Minute Ventilation Rate Responsive Pacemakers. In this case, set the pacemaker rate responsive mode off or turn the monitor impedance respiration measurement off.
- Never install the monitor or the displays so that they are above the patient.
- The monitor must not be used without manufacturer approved mounting attached.

Cleaning and service

- Only trained personnel with proper tools and test equipment should perform the tests and repairs described in this manual. Unauthorized service may void the monitor warranty.
- Turn the power off and unplug the power cord before cleaning or service. Completely remove any moisture before reconnecting the power cord to the mains outlet.
- Do not touch any exposed wire or conductive surface while any cover is removed and the monitor is energized. The voltages present can cause injury or death.
- Pins of connectors identified with the ESD warning symbol should not be touched. Connections should not be made to these connectors unless ESD precautionary procedures are used. For details, see 1.2.2. ESD precautionary procedures.
- Always perform an electrical safety check and a leakage current test on the monitor after service.

Accessories

- Use only accessories, including mounts and batteries, and defibrillator-proof cables and invasive pressure transducers approved by GE Healthcare. For a list of approved supplies and accessories, see the “Supplies and Accessories” catalog delivered with the monitor. Other cables, batteries, transducers and accessories may cause a safety hazard, damage the equipment or the system, result in increased emissions or decreased immunity of the equipment or system or interfere with the measurement. Protection against cardiac defibrillator discharge is due in part to the accessories for pulse oximetry (SpO2), temperature (T) and invasive pressure (P) measurement.
- Single use accessories are not designed to be reused. Reuse may cause a risk of contamination and affect the measurement accuracy.

Cautions

CAUTION A CAUTION indicates a condition that may lead to equipment damage or malfunction.

Installation

- Leave space for air circulation to prevent the monitor from overheating.
- Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.
- Before connecting the power cord to the mains outlet, check that the local voltage and frequency correspond with the rating stated on the device plate on the rear panel of the monitor. See instructions for different displays in section “Displays”.
- Turn off the power before making any rear panel connections.

Before use

- Allow two minutes for warm-up and note any error messages or deviations from normal operation.
- Clean the rear panel fan dust filters once a month or whenever necessary.
- Do not connect a sampling line to the female Patient Spirometry connector while the other end of the sampling line is connected to the D-fend water trap. The pressure in the gas sampling system may cause damage to the PVX unit pressure transducers.

Autoclaving and sterilizing

- Do not autoclave any part of the monitor.
- Do not gas sterilize the modules.

Cleaning and service

- Do not use hypoclorite, ammonia-, phenol-, or acetone based cleaners. These cleaners may damage the monitor surface.
- Do not immerse any part of the device in any liquid, or allow liquid to enter the monitor or modules.
- Do not apply pressurized air to any outlet or tubing connected to monitor.
- Electrostatic discharge through the PC boards may damage the components. Before handling PC boards, wear a static control wrist strap. Handle all PC boards by their non-conductive edges and use anti-static containers when transporting them.
- Do not break or bypass the patient isolation barrier when testing PC boards.
- Do not clean the spirometry tubes with high pressure air O2 flushing while the spirometry tubes are connected to Patient Spirometry connector. High differential pressure may damage PVX unit pressure transducers.

Special components

- Special components are used in these monitors that are vital to assure reliability and safety. GE Healthcare assumes no responsibility for damage, if replacement components not approved by GE Healthcare are used.
- A lithium battery on the CPU Board. Dispose of the faulty IC containing the battery according to local regulations.

Batteries

The battery packages in the central unit, F-CPU and in the power supply unit of F-CU8 contain lead acid (Pb) which is hazardous to the environment and therefore needs to be disposed of carefully according to local regulations.

To replace the batteries safely, please refer to the service instructions in this manual.

- Do not short-circuit the battery terminals, this may produce a very high current, which will damage the battery.
- Do not dispose of the battery into open flame, nor put the battery near fire, as it may explode.

- Do not dismantle the battery. It contains electrolyte, which may damage clothing or cause injury to skin or eyes. If exposed to electrolyte, wash the injured area with plenty of clean water and contact a doctor.

See also section "Symbols".

Storage and transport

Do not store or transport the monitor outside the specified temperature, pressure and humidity ranges:

Temperature	-10...+50 °C/14...122 °F
Atmospheric pressure	660...1060 hPa/500...800 mmHg/660...1060 mbar
Relative humidity	10...90% non-condensing

For display specific environmental requirements see specifications in the "Display" slot.

1.2.2 ESD precautionary procedures

- To avoid electrostatic charges to build up, it is recommended to store, maintain and use the equipment at a relative humidity of 30% or greater. Floors should be covered by ESD dissipative carpets or similar. Non-synthetic clothing should be used when working with the component.
- To prevent applying a possible electrostatic discharge to the ESD sensitive parts of the equipment, one should touch the metallic frame of the component or to a large metal object located close to the equipment. When working with the equipment and specifically when the ESD sensitive parts of the equipment may be touched, a grounded wrist strap intended for use with ESD sensitive equipment should be worn. Refer to the documentation provided with the wrist straps for details of proper use.

ESD precautionary procedure training

It is recommended that all potential users receive an explanation of the ESD warning symbol and training in ESD precautionary procedures.

The minimum contents of an ESD precautionary procedure training should include an introduction to the physics of electrostatic charge, the voltage levels that can occur in normal practice and the damage that can be done to electronic components if they are touched by an operator who is electrostatically charged. Further, an explanation should be given of methods to prevent build-up of electrostatic charge and how and why to discharge one's body to earth or to the frame of the equipment or bond oneself by means of a wrist strap to the equipment or the earth prior to making a connection.

1.2.3 Disposal

Dispose of the whole device and parts of it according to local environmental and waste disposal regulations.

2 System description

2.1 Introduction

Datex-Ohmeda monitors build up a freely configurable modular system. The architecture is designed to enable different module combinations so that the user is able to get the desirable parameter and feature set. This modular approach makes it possible to add new features when they are needed.

2.2 Bus structure

The operation of Datex-Ohmeda monitors is based on two communication channels, the CPU bus and module bus.

In the 5-Module Central Unit, PC boards receive power from the F-CPU power supply and the parameter modules receive power from a separate power supply in the 5-Module Frame unit. These power supplies are both fed by the N-AC Power Unit. In the 8-Module Central Unit, F-CU8, all PC boards connected to the CPU bus, as well as the parameter modules attached to the module bus receive power from the same power supply, which is an integral part of the Central Unit, F-CU8.

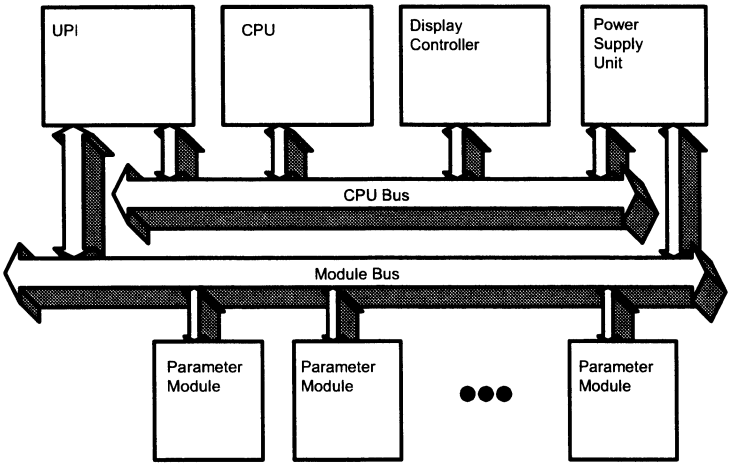


Figure 1 **General bus structure of S/5 system**

The CPU bus is a communication channel used only for internal data transfer. It is based on the ISA bus used in IBM PC computers. Data is transferred on this 16 bit wide bus using the CPU clock frequency.

The module bus is used to connect the parameter modules to the Central Unit. The bus is based on the industry standard RS-485, which uses a differential serial method to transfer data. This type of bus is robust and it allows parameter modules to be inserted or removed while the power is on. The module bus uses a 500 kbps data transfer rate and can be used for longer distances than the CPU bus, e.g. for external frame connections.

The RS-485 type of serial communication supports so-called multidrop or party line connections. This means that all parameter modules connected to the module bus use exactly the same lines for communication. The advantage of this is that all bus connectors are identical and the modules can be connected in any order and position.

2.3 Distributed processing

A system assembled from S/5 products is a multiprocessor system. All parameter modules have their own microprocessor, which performs functions such as module key control, waveform filtering, parameter related computing and pneumatic control, etc. At the same time the main CPU performs higher level tasks such as trending and alarm control. While the parameter modules and CPU are performing their tasks, the UPI (Universal Peripheral Interface) microprocessor handles all functions needed to transfer data between the parameter modules and the CPU. At the same time the Display controller microprocessor performs pixel calculations for graphics.

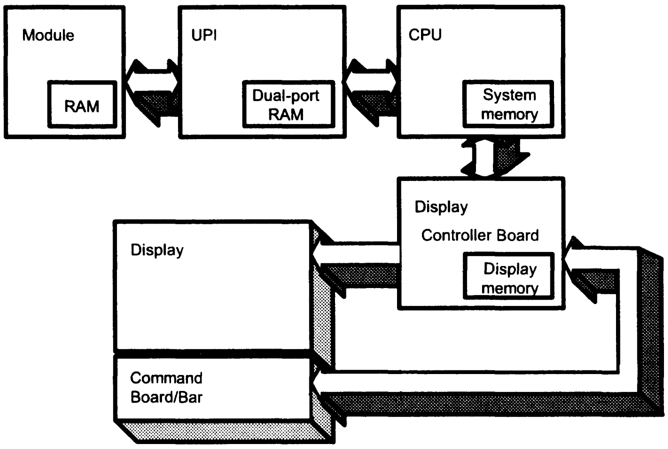


Figure 2 **Distributed processing in S/5 system**

This kind of parallel processing gives one major advantage to centralized processing. When new parameter modules or PC boards are added to the system, the processing power is increased. As a result, the system does not slow down when new features are added.

2.4 Module communication

The communication master controlling data transfers between the CPU and parameter modules is called UPI processor. It sends data to each connected module 100 times a second. Modules respond to each data request immediately by sending a data package, whose length depends on the type of the module. This communication protocol ensures that each module receives and sends data every 10 ms. If a module does not respond to data requests, the UPI processor presumes that the module is disconnected.

Parameter modules may hold a static (fixed) or dynamic address, which the UPI processor uses when sending out data. Two parameter modules of the same type must not be fitted onto the same monitor since they might reply to a data request simultaneously, thus causing communication errors.

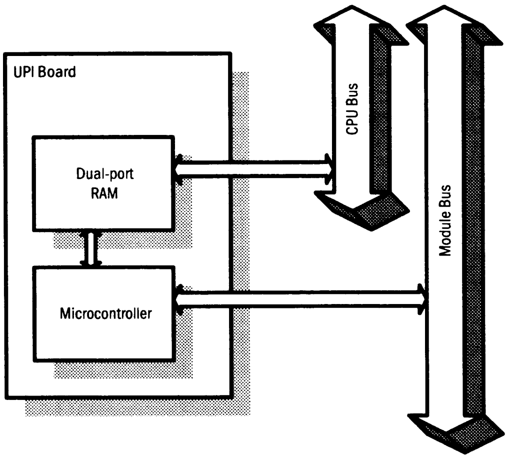

UPI Board
Dual-port RAM
Microcontroller
CPU Bus
Module Bus

Figure 3 **Principle of UPI section operation**

The UPI processor collects and stores all data that is received from the parameter modules into a dual port RAM, which is mapped directly to the address space of the main CPU. The main CPU reads data from the memory while the UPI processor guarantees that the data is up to date. This operation also works in the other direction. In this the main CPU fills the dual port RAM with data and the UPI processor distributes it to the parameter modules.

2.5 Software loading

The program memory on CPU board is loaded with monitor software at the factory. The software is used for running all the functions that are integrated into the PC board. For service and upgrade procedures the CPU board is fitted with a PCMCIA card drive through which new software can be loaded.

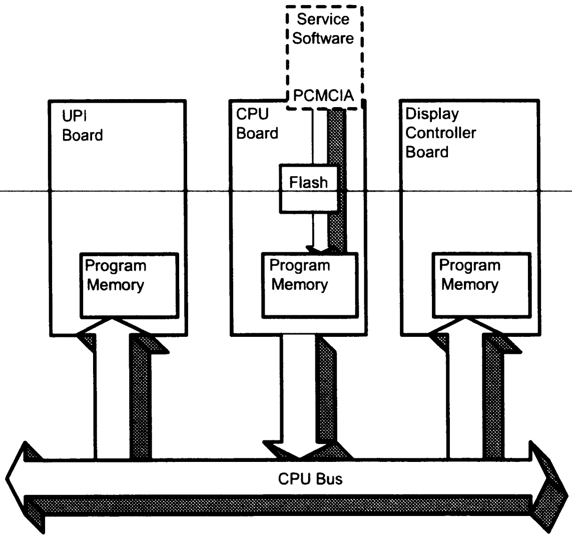

Service Software
PCMCIA
UPI Board
CPU Board
Display Controller Board
Flash
Program Memory
Program Memory
Program Memory
CPU Bus

Figure 4 **Software loading**

2.6 Parameter modules

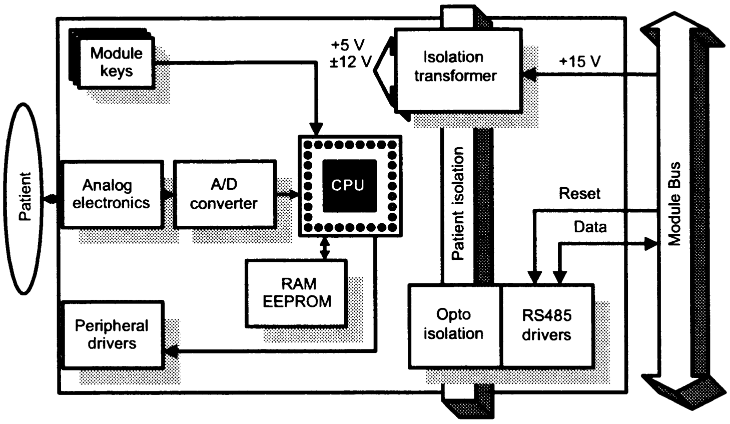

Module keys
+5 V
±12 V
Isolation transformer
+15 V
Patient
Analog electronics
A/D converter
CPU
Patient isolation
Reset
Data
Module Bus
RAM EEPROM
Peripheral drivers
Opto isolation
RS485 drivers

Figure 5 General structure of parameter modules with patient isolation

The detailed structure of a parameter module depends on the specific needs for each individual parameter. However, some common parts are used in the parameter modules. The electronics inside the module is usually divided into isolated (floating) and non-isolated sections. Typically, the non-isolated section consists of buffers to interface the parameter module to the module bus while the rest of the electronics is located in the isolated section. The isolated section includes the microcontroller together with memory components, the front-end analog electronics (amplifiers, etc.) and sensor drives.

3 System installation

3.1 Unpacking instructions

1. Confirm that the packing box is undamaged. If the box is damaged, contact the shipper.
2. Open the top of the box and carefully unpack all components.
3. Confirm that all components are undamaged. If any of the components are damaged, contact the shipper.
4. Confirm that all components are included. If any of the components are missing, contact your GE Healthcare distributor.

3.2 Choosing location

Consider the following aspects:

- lighting
- space
- connections
- electromagnetic and radio frequency interference, see Appendix B. ElectroMagnetic Compatibility
- environment

WARNING **The monitor or its components should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the monitor and its components should be observed to verify normal operation in the configuration in which it will be used.**

3.3 Central Unit; S/5 8-Module Frame, F-CU8

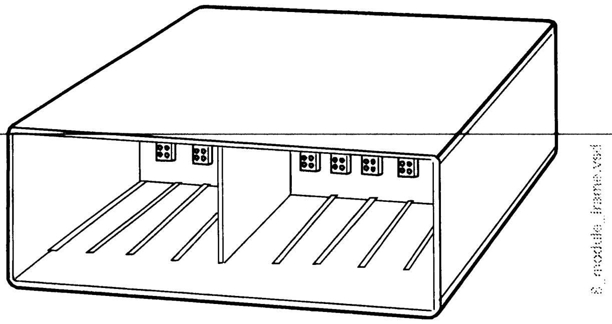


Figure 6 Central Unit: S/5 8-Module Frame, F-CU8

The front of the Central Unit, F-CU8, houses plug-in parameter modules which interface the system with external devices. The back of the Central Unit houses the system circuit boards, together with expansion slots which accommodate PC boards which interface with external devices and the Datex Ohmeda Network.

3.3.1 Connecting to mains

Connect the power cord to the mains power inlet on the rear of the Central Unit and to the wall socket.

WARNING **The power cord may only be connected to a three-wire, grounded, hospital grade receptacle.**

3.3.2 Connecting to Datex Ohmeda Network

To connect the monitor to the Datex Ohmeda Network, make sure a Network Board B-UPI4NET is installed.

Use the Monitor-Network cable to connect the monitor to the network as follows:

1. Make sure that the power to the Central Unit is turned off.
2. Connect the RJ-45 connector and the Identification Plug to the corresponding connectors on the B-UPI4NET.
3. Connect the other RJ-45 connector to the corresponding connector on the wall box.
4. Turn on the power to the Central Unit. Enter the ***Network*** service menu:

   Monitor Setup - ***Install/Service*** (password 16-4-34) -
   Service (password 26-23-8) -
   Frame - Network
5. Make sure that the monitor's network communication has been set according to the used network software:

   Network software S-CNET01 -> DRI Level = 2001
   Network software S-CNET02 -> DRI Level = 2001
   Network software L-NET03 -> DRI Level = 2003
   Network software L-NET05 -> DRI Level = 2005

   If necessary, change the monitor's network communication by selecting ***DRI Level*** and turning the ComWheel.

   NOTE: If the DRI level is changed, the monitor will restart automatically.
6. Confirm that the network symbol and 'Connected to Network' message are displayed on the upper part of the screen.

3.3.3 Inserting the parameter modules

1. Ensure that the module is properly orientated (i.e. module release latch facing downward).
2. Align the module insertion guide slot with the insertion guide.
3. Push the module into the frame until it clicks.

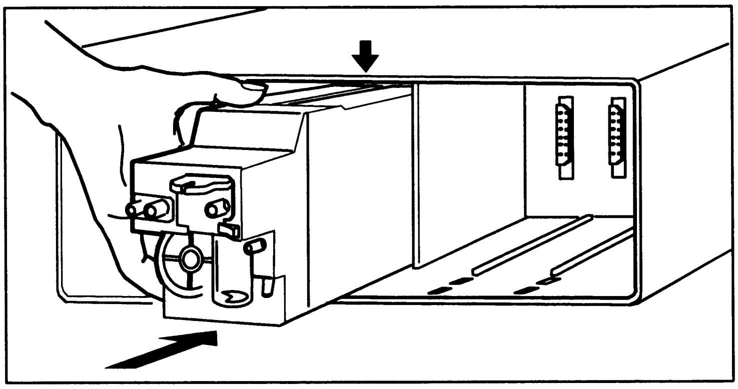


Figure 7 Module insert

NOTE: The Compact Airway Modules cannot be placed into the third and fourth slot from the right-hand side of the F-CU8 Central Unit.

NOTE: Use only one Extension Frame F-EXT4 in one F-CU8 Central Unit.

NOTE: Do not use two or more parameter modules with identical functions in the monitor system. Take special care not to do this when using the Extension Frame, F-EXT4.

Parameter modules or boards with identical functions are:

- Hemodynamic multiparameter modules, E-PRESTN, E-PRETN, E-RESTN, M-PRESTN, M-PRETN, M-RESTN, M-ESTPR, M-ETPR, M-ESTR, M-NESTPR, M-NETPR, M-NESTR, M-NE12STPR, M-NE12TPR, M-NE12STR
- Dual Pressure Modules, E-PP/M-PP
- Pressure Modules, E-P/ M-P, Pressure Temp Module, E-PT/ M-PT
- Cardiac Output Modules, E-COP, E-COPSv, M-COP and M-COPSv
- NIBP Modules, M-NIBP and hemodynamic modules w/ N measurement
- Airway Modules, E-CO, E-COV, E-COVX, E-CAiOVX, E-CAiOV, E-CAiO, E-miniC, M-C, M-CO, M-COV, M-CAiO, M-CAiOV, M-CAiOVX, G-O, G-OV, G-AO, G-AiO, G-AOV, G-AiOV, M-MiniC
- Interface Module, E-INT / M-INT and Interface Board, B-INT
- Oxygen Saturation Modules, E-NSAT/ M-NSAT and M-OSAT
- Tonometry Modules, E-TONO/ M-TONO
- NeuroMuscular Transmission Modules, E-NMT/ M-NMT
- EEG Modules, E-EEG/ M-EEG
- BIS Modules, E-BIS/ M-BIS

3.3.4 Positioning of PC boards

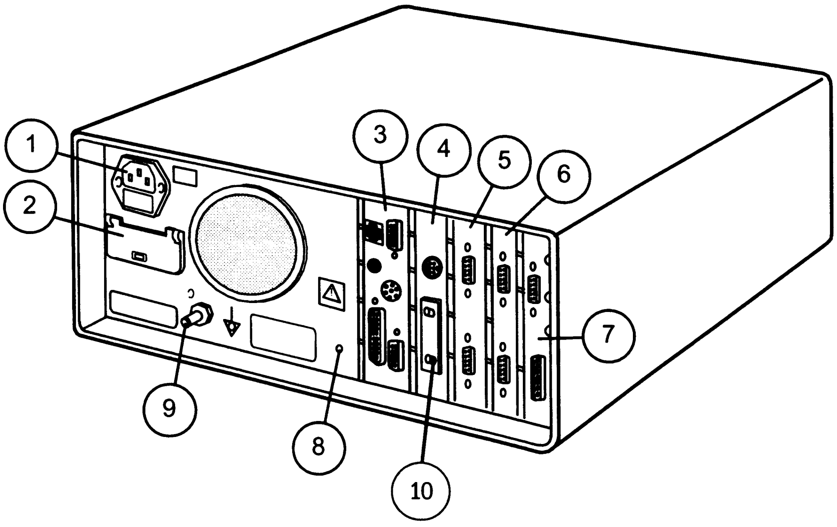


Figure 8 Rear view and positioning, F-CU8 rev. 10

(1) Mains power inlet

(2) Battery 24 Vde input connector (F-CU8 rev. 10)/ Display power outlet (F-CU8 rev. 03 to 09)

(3) UPINET Board, B-UPI4NET

(4) CPU Board, B-CPU5

(5) Display Controller Board, B-DISPX (primary/screen 1)

(6) Display Controller Board, B-DISPX (secondary/screen 2),
Keyboard Interface Board, B-ARK

(7) Interface Board, B-INT,
Gas Interface Board, B-GAS,
Display Controller Board, B-DISPX (3rd screen)

(8) Service reset button

(9) Equipotential connector

(10) Back plate lid for CPU Board, B-CPU5

NOTE: Authorized personnel only may open the cover of 24Vdc input connector (use a flat screwdriver).

3.3.5 Replacing PC Boards

For service procedures refer to Part II.

1. Make sure that the power is turned off the monitor and unplug the power cord. Press and hold the service reset button on the rear panel for at least five seconds or until an audible tone is heard (see Figure 9).

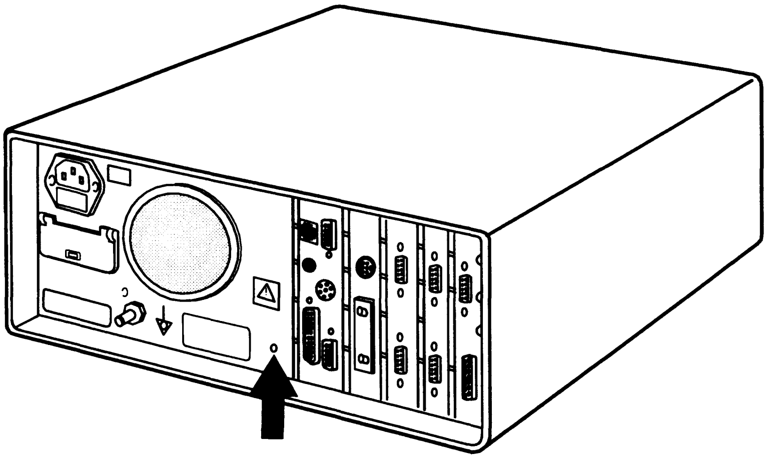


Figure 9 Service reset button

2. Remove all PC boards, cover plates and EMC plates on the right-hand side of the PC board, to be replaced, then remove the board itself (two screws).

NOTE: The B-UPI4(NET) may have been installed so that it can be removed without removing the other PC boards first.

CAUTION The circuit boards contain sensitive integrated circuits that can be damaged by an electrostatic discharge. Careful handling of the boards is therefore essential.

NOTE: The B-UPI4(NET) contains components on both sides of the PCB. Therefore, the installation of B-UPI4(NET) should be handled with extra care. Detach the board from the frame carefully by pulling it from the X3 connector (25 pin female D-connector).

3. Remove the new PC board from the protective antistatic packaging. Always hold the board by the edges and wear a wrist-grounding strap.
4. Insert the new PC board into the vacant slot and firmly press the board into position. Secure the board (two screws).
5. Insert all other circuit boards, cover plates and EMC plates.
6. Reconnect the power cord.

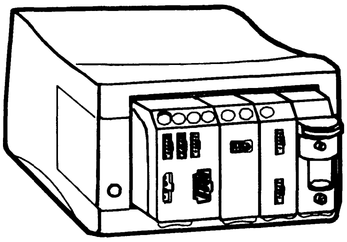
3.3.6 Performing Factory Reset

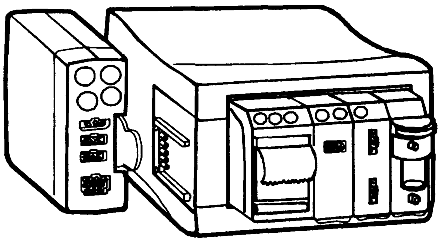
NOTE: The factory reset is necessary after downloading of monitor software and after replacing the CPU board or SRAM/Timekeeper battery.

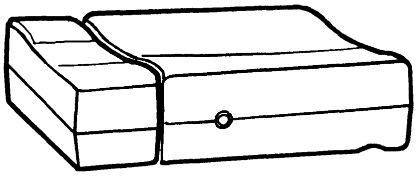
NOTE: A factory reset will restore all customized defaults, including language selection, to factory defaults.

1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** and password (16-4-34).
3. Select ***Service*** and password (26-23-8).
4. Select ***Set/Test*** and perform a Factory Reset.
5. The monitor will perform an automatic restart. After the restart is completed, restart the monitor also manually by the On/Standby switch.

3.4 Central Unit; S/5 5-Module Frame, F-CU5







The central unit is divided into three parts: the 5-Module Frame F-CU5(P), the Central Processor Unit F-CPU and the universal power unit N-AC.
The 5-Module Frame has two options, a frame with the possibility to connect a E-PSM(P) module (F-CU5P) to, and a frame without the possibility to connect a E-PSM(P) module (F-CU5) to.
F-CU5 provides places for up to five single-width modules or two double-width modules (plus one slot for one single-width module) and in F-CU5P a connector plate for E-PSM or E-PSMP.
The Central Processor Unit houses the system circuit boards.

NOTE: You can connect two F-CU5(P) 5-Module Frames to one F-CPU. If you do so, you cannot at the same time use a display that uses B-DISPX as power supply (for example 12" LCD display).

WARNING **After transferring or reinstalling the monitor, always check that it is properly connected and all parts are securely attached. Pay special attention to this in case of stacked mounting.**

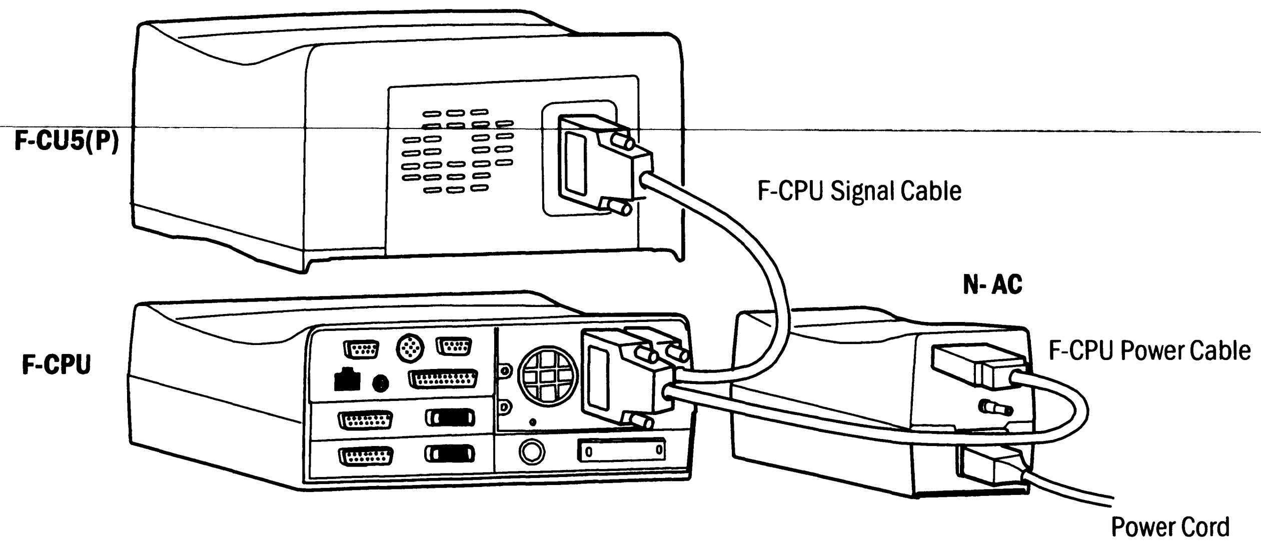


Figure 10 F-CU5 parts connected with cables

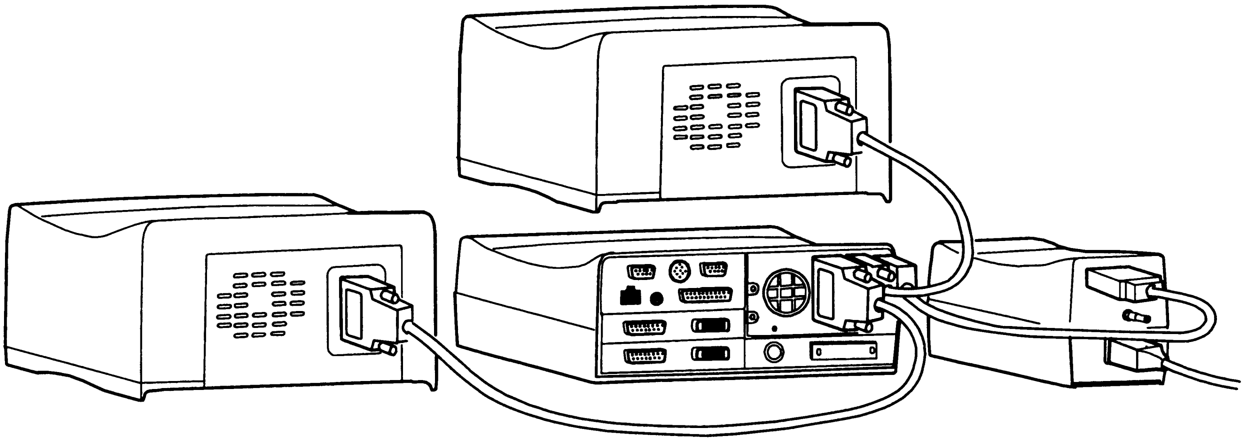


Figure 11 **Two F-CU5s connected to one F-CPU**

3.4.1 Mounting the Frame

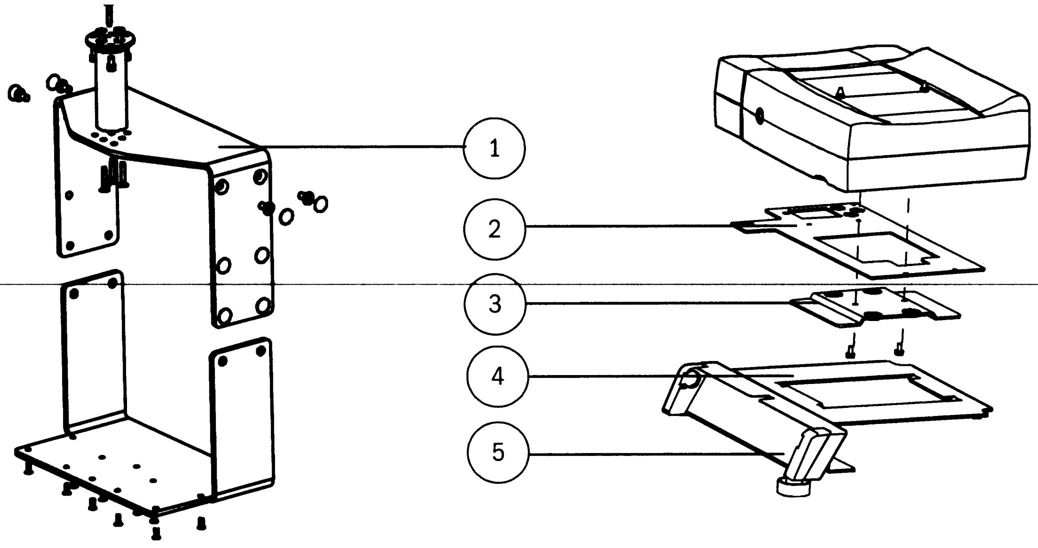
The various mount options and connecting cables allow you to install the F-CU5(P) 5-Module Frame, F-CPU Central Processor Unit and N-AC Power Unit either in one package or separately. You can, for example, attach the Central Processor Unit and Power Unit to the wall or table leg and have the Central Unit at hand.

There are different interconnecting cable options available:

F-CPU Power Cable 0.4 m/16 inch and 2.7 m /9 ft

F-CPU Signal Cable 0.3 m/12 inch, 3m/10 ft and 10m/33 ft

The different mounts to install the Central Unit F-CU5



(1) Wall Mount Hanger for S/5 F-CU5

(2) Power Adapter Mount for F-CU5 Power Unit N-AC

(3) Adapter Plate for S/5 F-CU5

(4) Table Holder for S/5 F-CU5

(5) Holder for S/5 Command Bar

3.4.2 Connecting to mains

Make sure the cables connecting the different units together are connected and secured.

Connect the power cord to the mains power inlet on the N-AC power unit, and to the wall socket.

WARNING **The power cord may only be connected to a three-wire, grounded, hospital grade receptacle.**

3.4.3 Connecting to Datex Ohmeda Network

To connect the monitor to the Datex Ohmeda Network, make sure a Network Board B-UPI4NET is installed.

Use the Monitor-Network cable to connect the monitor to the network as follows:

1. Make sure that the power to the Central Unit is turned off.
2. Connect the RJ-45 connector and the Identification Plug to the corresponding connectors on the B-UPI4NET.
3. Connect the other RJ-45 connector to the corresponding connector on the wall box.
4. Turn on the power to the Central Unit. Enter the ***Network*** service menu: **Monitor Setup** - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8) - ***Frame - Network***
5. Make sure that the monitor's network communication has been set according to the used network software:

   Network software S-CNET01 -> DRI Level = 2001

   Network software S-CNET02 -> DRI Level = 2001

   Network software L-NET03 -> DRI Level = 2003

   Network software L-NET05 -> DRI Level = 2005

   If necessary, change the monitor's network communication by selecting DRI Level and turning the ComWheel.

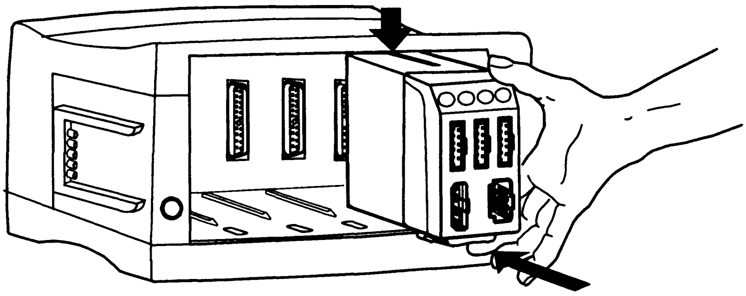
NOTE: If the DRI level is changed, the monitor will restart automatically.

6. Confirm that the network symbol and 'Connected to Network' message are displayed on the upper part of the screen.

* * *

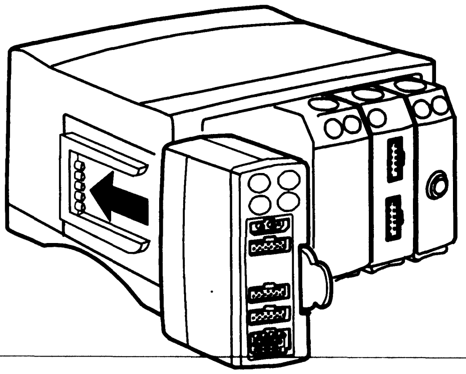
3.4.4 Inserting the Parameter Modules

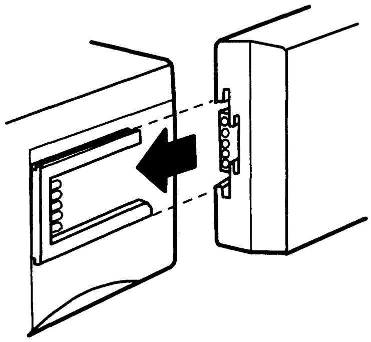
1. Ensure that the module is properly orientated (i.e. module release latch facing downward).
2. Align the module insertion guide slot with the insertion guide.
3. Push the module into the frame until it clicks.



NOTE: Do not use two or more parameter modules with identical functions in the monitor system. Take special care not to do this when using two F-CU5(P) module frames.

Inserting PSM modules





1. Align the module with the insertion guides.
2. Push the module into the monitor frame until it stops.
3. Pull the module outwards. Make sure not to drop it when it comes out.

WARNING **When detaching modules, be careful not to drop them. Always support with one hand while pulling out with the other.**

Parameter modules or boards with identical functions are:

- Hemodynamic multiparameter modules, E-PRESTN, E-PRETN, E-RESTN, E-PSM, E-PSMP, M-PRESTN, M-PRETN, M-RESTN M-ESTPR, M-ETPR, M-ESTR, M-NESTPR, M-NETPR, M-NESTR, M-NE12STPR, M-NE12TPR, M-NE12STR
- Dual Pressure Modules, E-PP/M-PP
- Pressure Modules, E-P/ M-P, Pressure Temp Module, E-PT/ M-PT
- Cardiac Output Modules, E-COP, E-COPS, M-COP and M-COPSv
- NIBP Modules, M-NIBP and hemodynamic modules w/ N measurement
- Airway Modules, E-CO, E-COV, E-COVX, E-CAiOVX, E-CAiOV, E-CAiO, E-miniC, M-C, M-CO, M-COV, M-CAiO, M-CAiOV, M-CAiOVX, M-MiniC
- Interface Module, M-INT and Interface Board, B-INT
- Oxygen Saturation Modules, E-NSAT, M-NSAT and M-OSAT
- Tonometry Modules, E-TONO/ M-TONO
- NeuroMuscular Transmission Modules, E-NMT/ M-NMT
- EEG Modules, E-EEG/ M-EEG
- BIS Modules, E-BIS/ M-BIS

3.4.5 Positioning the PC boards

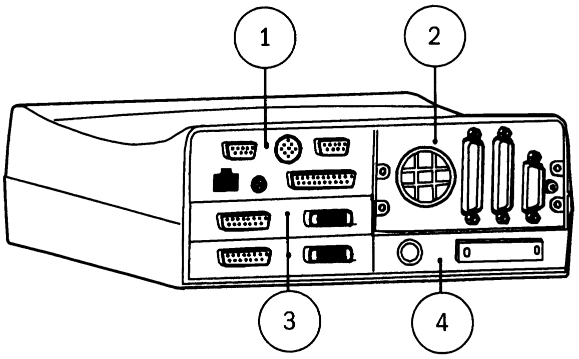


Figure 12 PC boards

(1) B-UPI4NET board
(2) DC Power board
(3) Display controller board, B-DISPX (maximum 2 pcs)
(4) CPU board, B-CPU5

3.4.6 Replacing PC boards

For service procedures refer to Part II.

1. Make sure that the power is turned off the Monitor and unplug the power cord. Press and hold the service reset button on the rear panel of the F-CPU for at least five seconds or until an audible tone is heard (see Figure 13).

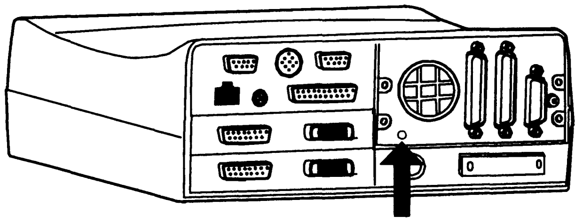


Figure 13 Service reset button

2. Remove the PC board (two screws).

CAUTION The circuit boards contain sensitive integrated circuits that can be damaged by an electrostatic discharge. Careful handling of the boards is therefore essential.

NOTE: The B-UPI4(NET) contains components on both sides of the PCB. Therefore, the installation of B-UPI4(NET) should be handled with extra care. Detach the board from the frame carefully by pulling it from the X3 connector (25 pin female D-connector).

3. Remove the new PC board from the protective antistatic packaging. Always hold the board by the edges and wear a wrist-grounding strap.
4. Insert the new PC board into the vacant slot and firmly press the board into position. Secure the board (two screws).
5. Insert all other circuit boards, cover plates and EMC plates.
6. Reconnect the power cord.

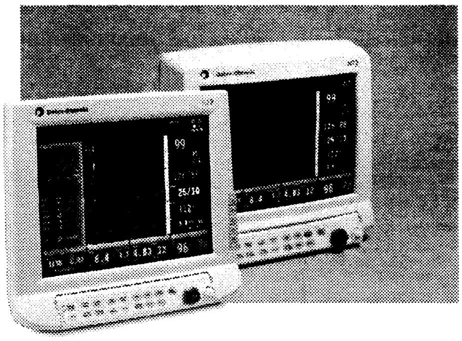
3.4.7 Performing Factory Reset

NOTE: The factory reset is necessary after downloading of monitor software and after replacing the CPU board or SRAM/Timekeeper battery.

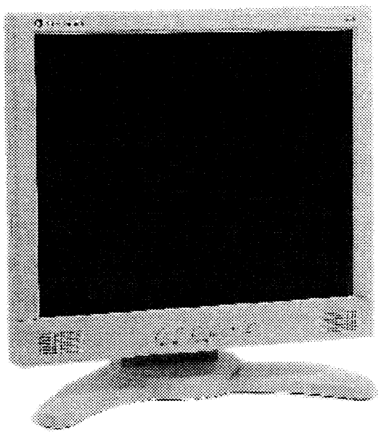
~~NOTE: A factory reset will restore all customized defaults, including language selection, to factory~~ defaults.

1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** and password (16-4-34).
3. Select ***Service*** and password (26-23-8).
4. Select ***Set/Test*** and perform a Factory Reset.
5. The monitor will perform an automatic restart. After the restart is completed, restart the monitor also manually by the On/Standby switch.

3.5 Displays



D-LCC15 and D-VMC15



D-LCC19

Figure 14 Display options

3.5.1 Main displays

All options available for the main display are integrated with a S/5 Command Board or S/5 Command Bar and a ComWheel unless otherwise noted:

- S/5 Video Display, D-VMC15
- Video Display, D-VNC15
- S/5 LCD Display, D-LCC17 (w/o Command Bar)
- S/5 LCD Display, D-LCC15
- S/5 LCD Display, D-LCC10A
- S/5 LCD Display, D-LCC12A
- S/5 Video Display, D-VHC17 + Wall Mount

NOTE: Only one LCD display (D-LCC10 or D-LCC12) that uses B-DISPX as the power supply can be used in a system where one F-CU5(P) 5-Module Frame is connected to Central Unit F-CPU.

NOTE: An LCD display that uses B-DISPX as the power supply (D-LCC10 or D-LCC12) cannot be used in a system where two F-CU5(P) Central Units are connected to one F-CPU.

3.5.2 Secondary displays

- S/5 LCD Display D-LCC19
- S/5 21" Display Monitor Unit, D-VSC21
- S/5 Plasma Display, D-MMP42
- S/5 Plasma Display, D-MMP43

However, the secondary display can also be any of the main displays listed above.

3.5.3 3rd display

The 3rd display can be installed together with the Display Controller Board, B-DISP rev.01 (or higher), B-DISP19 and B-DISPX. All S/5 main softwares support the use of the 3rd display.

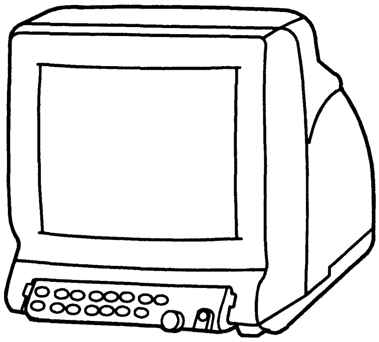
NOTE: Due to increased power consumption only two LCD displays should take power via the Central Unit simultaneously.

3.5.4 Display installation

NOTE: Please pay attention to any additional instructions that may accompany the displays and / or their installation equipment. The instructions described below in this manual may not contain all the necessary information.

NOTE: When connecting a display with a DVI-I type digital video cable, some adjustments are not needed and may not be available in the display's on-screen adjustment menu (OSD).

3.5.5 S/5 Video Display, D-VMC15



Mounting to Central Unit, F-CU8

Attach the Command Bar, K-ANEB / K-ICUB into the Video Display, D-VMC15 housing and pull the Command Bar cable under the display to the rear. Mount the display to the Central Unit using the display alignment studs on top of the frame.

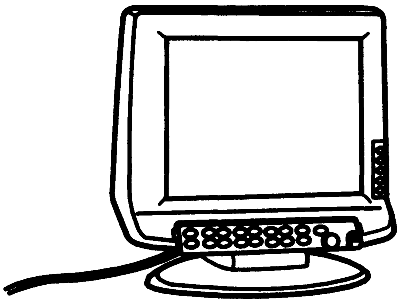
Connection to Central Unit

1. Make sure that power to the Central Unit is turned off.
2. Make sure that the switch on the Command Bar is turned to standby. Connect the Command Bar cable to the connector X3 on the Display Controller Board, B-DISP. Tighten the screws.
3. Connect the video cable to the connector X2 on the Display Controller Board, B-DISP. Tighten the finger screws.
4. Connect the display power cord to the mains outlet.

Adjustments

Adjust the brightness and contrast using the control keys on the display housing.

3.5.6 S/5 LCD Display, D-LCC15



Mounting to Central Unit

Connect the video cable and power adapter cable to the LCD Display, D-LCC15. Tighten the video cable finger screws. Attach the Command Bar, K-ANEB / K-ICUB into the display housing. Mount the display together with the desk stand to the Central Unit using the display alignment studs on the top of the frame (applies to Central Unit, F-CU8 only.

Mounting

Mount the LCD Display, D-LCC15 to a pedestal, wall or ceiling mount, or to a display arm with appropriate parts.

Connection to Central Unit

1. Make sure that power to the Central Unit is turned off.
2. Make sure that the switch on the Command Bar is turned to standby. Connect the Command Bar cable to the connector X3 on the Display Controller Board, B-DISP, B-DISP19 or B-DISPX. Tighten the screws.
3. Connect the video cable to the connector X2 on the Display Controller Board, B-DISP, B-DISP19 or B-DISPX. Tighten the finger screws.
4. Connect the display power cord to the mains outlet.

WARNING **The display must be used only together with the original D-LCC15 power adapter.**

Adjustments

Adjust the brightness and contrast using the control keys on the display housing.

NOTE: The control keys can be unlocked/locked by pressing the -, + and v keys simultaneously.

If the display picture is unclear, make the following adjustments:

1. If the picture looks much larger than the display screen, the video signal is set to ***HIRES*** and must be changed to ***XGA***-resolution from the S/5 monitor software.
   Go to **Monitor Setup - - >** ***Install /Service - - > Installation - - > Display Setup menu*** and select ***XGA*** for appropriate display screen. Then switch the S/5 Monitor **OFF** and back **ON** again. The video signal resolution change is now effective.
   Similarly if the video signal is set to ***VGA,*** it has to be changed to ***XGA*** for best picture.

   NOTE: The ***XGA*** resolution setting must be made every time after a Factory Reset.
2. Select the HELP menu on screen from the Monitor Keyboard, and then activate the AUTO ADJUST function from the display's OSD menu (please refer to the display's Operations Manual).

3. If the AUTO ADJUST function cannot position the picture correctly, continue the adjustment by fine-tuning with the H-POSITION or V-POSITION adjustment(s).
   Adjust the horizontal position of the picture so that the left borderline or left most digit field is just visible.
   Adjust the vertical position of the picture so that the digit field's bottom borderline is just visible (please refer to the display's Operations Manual).
4. If some parts of the texts flicker, continue the fine-tuning with the PHASE adjustment. Sometimes it may be necessary to fine-tune first with the CLOCK and then the PHASE adjustments (please refer to the display's Operations Manual).

3.5.7 15" Video Display, D-VNC15

Mounting to Central Unit

Mount the Video Display, D-VNC15, to the Central Unit using the display alignment studs on top of the frame.

Connection to Central Unit

1. Make sure that the power to the Central Unit is turned off.
2. Connect the display cable to the X2 connector on the Display Controller Board, B-DISP. Tighten the finger screws.
3. Connect the display power cord via an appropriate separating transformer to the wall power outlet.

WARNING ⚠ **The Video Display, D-VNC15, power cord may only be connected via an appropriate separating transformer to the wall power outlet.**
Connecting the display power cord directly to the wall power outlet will cause the leakage current to exceed the limit specified for medical equipment.

4. Connect the Command Board cable to the X3 connector on the Display Controller, B-DISP. Tighten the finger screws.

WARNING **Always make sure that the whole combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

Adjusting the display brightness and contrast

Adjust the display brightness and contrast using the controls illustrated below.

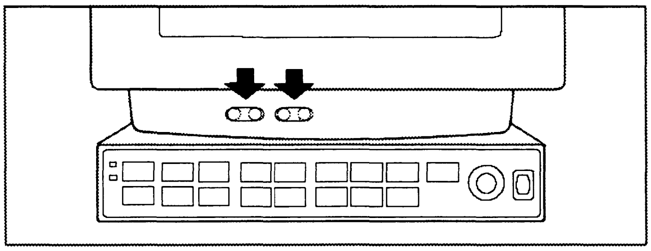


Figure 15 Brightness and contrast controls, D-VNC15

3.5.8 17" Video Display, D-VHC17, revision 00-01

The 17" Video Display, D-VHC17, can be used as a primary or a secondary display, e.g. to display monitored information close to the surgeon.

Please notice the differences between revisions 00-01 and 02.

WARNING ⚠ **The Video Display, D-VHC17, revision 00-01 power cord may only be connected to the wall power outlet. A separating transformer is built-into the display stand.**

WARNING **The Video display, D-VHC17, is wall-mountable only. The display must be mounted at 180 cm/71 in or higher to prevent any liquid entering the display casing.**

3.5.9 17" Video Display, D-VHC17, revision 02-03

Please notice the differences between revisions 00-01 and 02-03.

WARNING ⚠ **Connecting the power supply cord of the Video Display, D-VHC17 revision 02 or 03, to the wall power outlet may cause the display leakage current to exceed the limit specified for medical equipment. Always connect the display via an appropriate separating transformer to the wall power outlet.**

WARNING **The Video display, D-VHC17, is wall-mountable only. The display must be mounted at 180 cm/71 in or higher to prevent any liquid entering the display casing.**

3.5.10 10" LCD Display, D-LCC10A/W

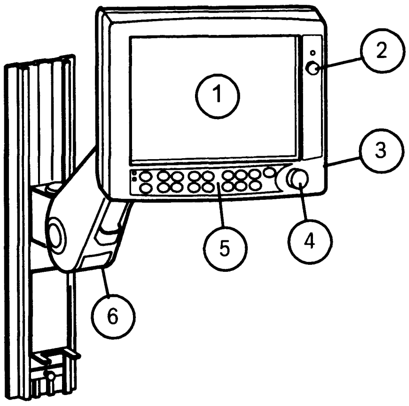
Mounting

Mount the LCD Display, D-LCC10A to a wall or to a display arm with appropriate parts. Connect the video cable to the display carefully.

Connection to Central Unit

1. Make sure that the power to the Central Unit is turned off.
2. Connect the monitor-LCD display cable to the X3 connector on the Display Controller Board, B-DISP and to the corresponding connector on the display. Tighten the finger screws.

3.5.11 12" LCD Display, D-LCC12A



(1) 12" LCD display, D-LCC12A
(2) Connector for the anesthesia record keeping solution keyboard or Remote Controller K-REMCO
(3) ON/STBY switch of the monitor
(4) ComWheel
(5) Command board keys
(6) Display Arm

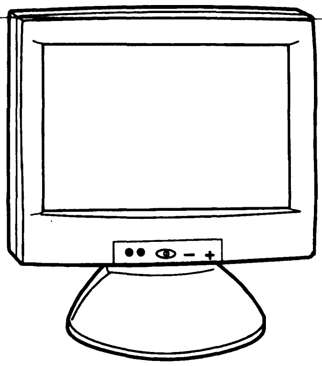
Mounting to Display arm

Mount the LCD Display, D-LCC12A to a pedestal, wall or ceiling mount, or to a display arm with appropriate parts. Connect the video cable to the display and tighten the video cable finger screws carefully.

Connection to Central Unit

1. Make sure that the power to the Central Unit is turned off.
2. Connect the video cable to the X3 connector on the Display Controller Board, B-DISP/B-DISP19/B-DISPX. Tighten the finger screws.

3.5.12 S/5 LCD Display, D-LCC17



The D-LCC17 is compatible with the S/5 Display Controller B-DISPX and B-DISP19.

Mounting

Mount the LCD Display, D-LCC17 to a pedestal, wall or ceiling mount, or a display arm with appropriate parts. Connect the video cable and power adapter cable to the display. Tighten the video cable finger screws.

Connection to Central Unit

1. Make sure that power to the Central Unit is turned off.
2. Connect the video cable to the connector X2 on the Display Controller Board, B-DISP19 or B-DISPX. Tighten the finger screws.
3. Connect the display power cord to the display power outlet or to the mains outlet.

WARNING **The display must be used only together with the original type of D-LCC17 power adapter.**

WARNING **Always make sure that the whole combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

Adjustments

Adjust the brightness and contrast using the control keys on the display housing. To perform needed adjustments, please, refer to the operations manual of the display.

If the screen size doesn't fit for the display, the screen resolution must be changed to ***SXGA***. To change the resolution:

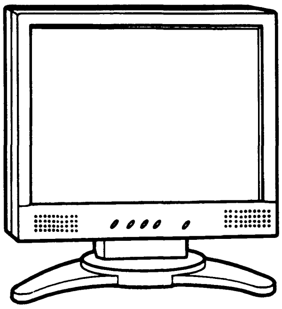
1. Press **Monitor Setup** and select ***Install/Service*** - - > ***Installation*** - - **>** ***Display Setup menu*** and select ***SXGA*** for appropriate display screen.
2. Switch the S/5 Monitor off and on again.

The video signal resolution change is now effective.

NOTE: The ***SXGA*** resolution setting must be made every time after a Factory Reset.

NOTE: Only resolutions supported by the display controller board are displayed. The D-LCC17 requires XGA resolution video signal if used together with display controller board B-DISP19 and monitor software -99 and later.

3.5.13 S/5 LCD Display, D-LCC19



Mounting

Mount the LCD Display, D-LCC19 to a pedestal, wall or ceiling mount, or display arm with appropriate parts. Connect the video cable to the display and tighten the video cable finger screws.

Connection to Central Unit

1. Make sure that power to the Central Unit is turned off.
2. Connect the video cable to the connector X2 on the Display Controller Board, B-DISP19 or B-DISPX.
   Tighten the finger screws.
3. Connect the display power cord to the display power outlet or to the mains outlet.

WARNING **The display must be used only together with the original type of D-LCC19 power adapter.**

WARNING **Connecting the power supply cord of the LCD Display, D-LCC19, to the wall power outlet may cause the display leakage current to exceed the limit specified for medical equipment. Always connect the display to an appropriate separating transformer.**

WARNING **The display D-LCC19 does not have a spill shielding. The display and the power adapter must be mounted at a height of 180cm / 71" or higher to prevent any liquid from entering the casing.**

WARNING **Always make sure that the whole combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

Adjustments

Adjust the brightness and contrast using the control keys on the display housing. To perform needed adjustments, please, refer to the operations manual of the display.

If the screen size doesn't fit for the display, the screen resolution must be changed to ***SXGA***. To change the resolution:

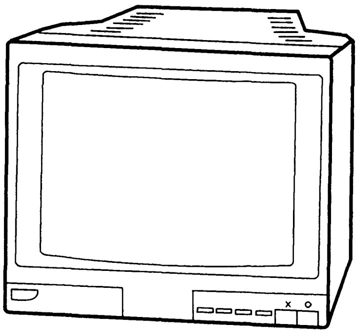
1. Press **Monitor Setup** and select ***Install /Service*** - - > ***Installation*** - - **>** ***Display Setup menu*** and select ***SXGA*** for appropriate display screen.
2. Switch the S/5 Monitor off and on again.

The video signal resolution change is now effective.

~~NOTE: The ***SXGA*** resolution setting must be made every time after a Factory Reset.~~

NOTE: Only resolutions supported by the display controller board are displayed. The D-LCC19 requires XGA resolution video signal if used together with display controller board B-DISP19 and monitor software -99 and later.

3.5.14 21" Display Monitor Unit, D-VSC21



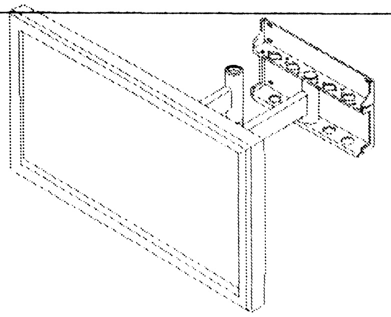
1. Make sure that the power to the Central Unit is turned off.
2. Connect the video cable to the X2 connector on the Display Controller Board, B-DISP or B-DISPX, and to the corresponding connector on the display. Tighten the finger screws.
3. Connect the display power cord via an appropriate separating transformer to the wall power outlet.

WARNING **The Display Monitor Unit, D-VSC21, does not have the top spill shielding. Make sure that the display is installed in a location, which is not susceptible to dripping liquids.**

WARNING ⚠ **Connecting the power supply cord of the Display Monitor Unit, D-VSC21, to the wall power outlet may cause the display leakage current to exceed the limit specified for medical equipment. Always connect the display to an appropriate separating transformer.**

WARNING **Always make sure that the whole combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

3.5.15 42" Plasma Display, D-MPP42 and 43" Plasma Display, D-MMP43



Mounting

For instructions concerning the mounting read the literature that is included in the display package or in the wall mount delivery.

NOTE: When the display is used with the desk stand option, it must be placed on a flat horizontal surface strong enough to safely carry the weight of the display and the desk stand.

Connection to the Central Unit

1. Make sure that the power to the Central Unit is turned off.
2. Connect the video cable to the X2 connector on the Display Controller Board, B-DISP, B-DISP19 or B-DISPX, and to the corresponding connector on the display. Tighten the finger screws.
3. Connect the display power cord via an appropriate separating transformer to the wall power outlet.

WARNING **The Plasma Display, D-MMP42 or D-MMP43, does not have the top spill shielding. Make sure that the display is installed in a location, which is not susceptible to dripping liquids.**

WARNING **Connecting the power supply cord of the Plasma Display, D-MMP42 or D-MMP43, to the wall power outlet may cause the display leakage current to exceed the limit specified for medical equipment. Always connect the display to an appropriate separating transformer.**

WARNING **Always make sure that the whole combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

NOTE: If the same image is displayed continuously, a permanent after image may remain on the screen. This is due to burning of the fluorescent material, and is typical for all plasma displays.

42" Plasma Display D-MMP42 and 43" Plasma Display D-MMP43 are not medical grade displays.

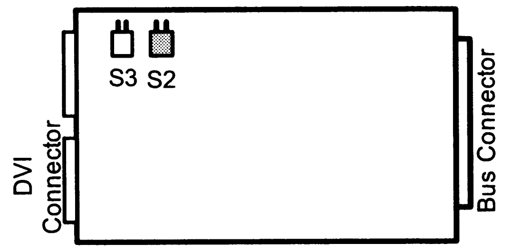
3.6 Display controller boards

Different displays must be supported by different display controllers, i.e. the primary display by a primary display controller, the secondary by a secondary display controller etc. Consequently, it is possible to configure the displays separately. One of the displays can, for instance, be used for a continuous display of trend pages.

NOTE: It is possible to use one display controller to obtain duplicate video signals for two displays by using the display Y-cable.

3.6.1 Jumper settings

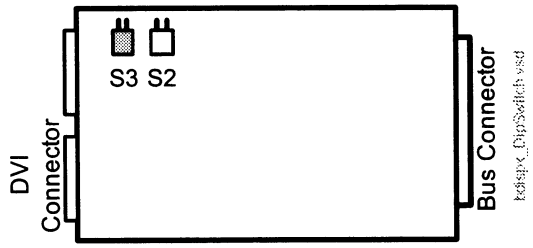
The display controllers require different address settings to operate correctly. The settings are made through dip switches (B-DISPX) or through the use of jumper caps to connect jumper pins (other display controller boards). Different settings are illustrated in the following figures.


S3 S2
DVI Connector
Bus Connector

Address settings are made by dip switch S2

	S2 switches	
	sw1	sw2
Primary	off	off
Secondary	on	off
Third	on	on

Figure 16 Address dip switch settings, B-DISPX


S3 S2
DVI Connector
Bus Connector

Resolution settings are made by dip switch S3

	S3 switches	
	sw1	sw2
Auto	off	off
VGA	off	on
SVGA	on	off
XGA	on	on

Figure 17 Resolution dip switch settings, B-DISPX

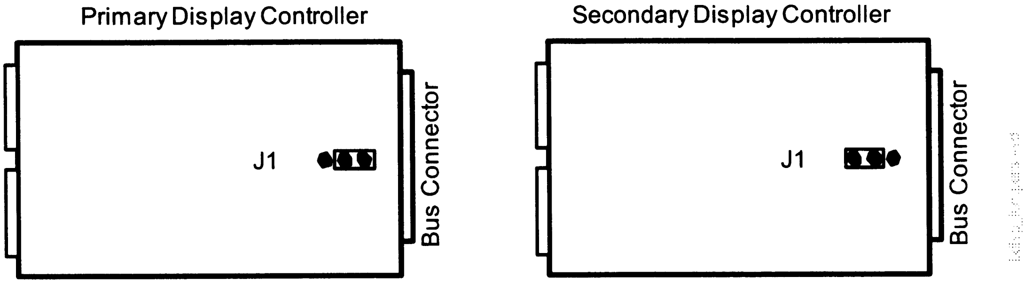

Primary Display Controller
J1
Bus Connector
Secondary Display Controller
J1
Bus Connector

Figure 18 Address jumper settings, B-DISP rev. 00

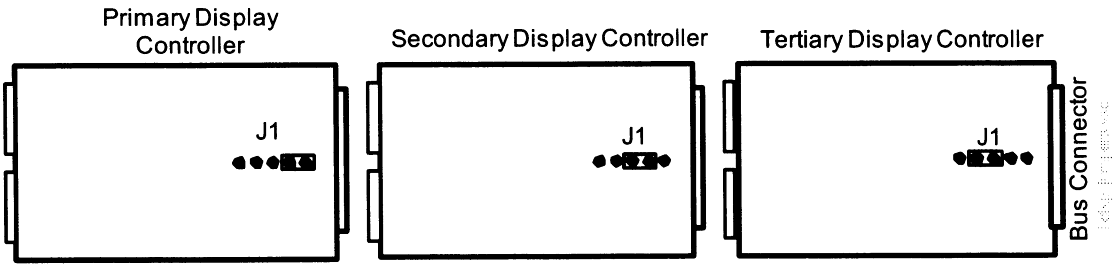

Primary Display Controller
J1
Secondary Display Controller
J1
Tertiary Display Controller
J1
Bus Connector

Figure 19 Address jumper settings, B-DISP rev. 01 (or higher) and B-DISP19

The AUTO/VGA jumper on B-DISP rev. 01 makes it possible to choose VGA resolution as restricted guidance.

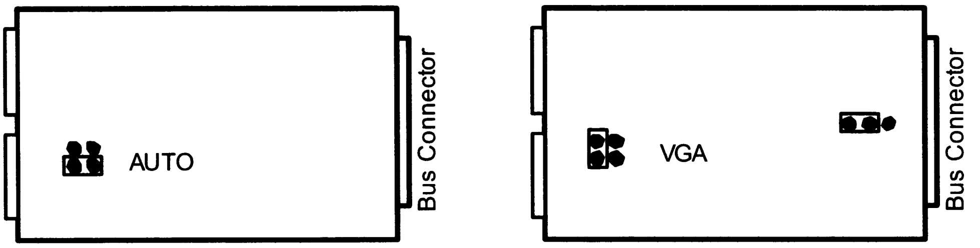

AUTO
Bus Connector
VGA
Bus Connector

Figure 20 **AUTO/VGA resolution jumper settings, B-DISP rev. 01, or higher and B-DISP19**

NOTE: B-DVGA rev. 01 and B-DHIGH rev. 01 boards can be configured only as primary or secondary display controllers by moving the location of jumpers J5 and J2 (board address and interrupt signal).

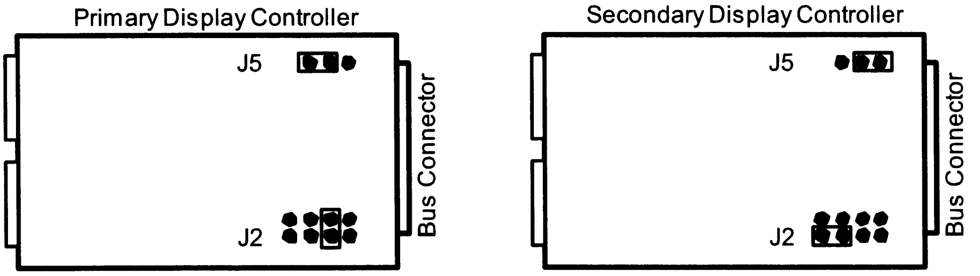

Primary Display Controller
J5
J2
Bus Connector
Secondary Display Controller
J5
J2
Bus Connector

Figure 21 **Address jumper settings B-DVGA board, rev. 01 and B-DHIGH board, rev. 01 (s/n < 174671)**

NOTE: B-DVGA rev. 02-03 and B-DHIGH boards rev. 01-02 can be configured only as primary or secondary display controllers.

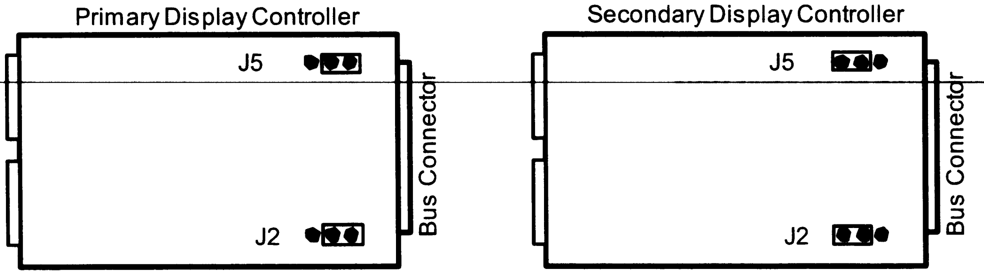

Primary Display Controller
J5
J2
Bus Connector
Secondary Display Controller
J5
J2
Bus Connector

Figure 22 **Jumper settings, B-DVGA board, rev. 02-03, and B-DHIGH board, rev. 01-02 (s/n > 174670)**

3.6.2 Resolution selection for B-DISPX

The resolution selection dip switch positions are presented in Figure 17 Resolution dip switch settings, B-DISPX. If the AUTO mode is selected, the resolution can be set by monitor software. In other modes, the resolution is set accordingly.

There is also an automatic resolution detection function for D-LCC10A/W displays in B-DISPX board. The status of X3 connector (keyboard connector) pins 4 and 5 (Mon_ID pins) are detected, and if pin 4 is grounded, the resolution is automatically set to VGA. The dip switch S3 affects these same pin statuses.

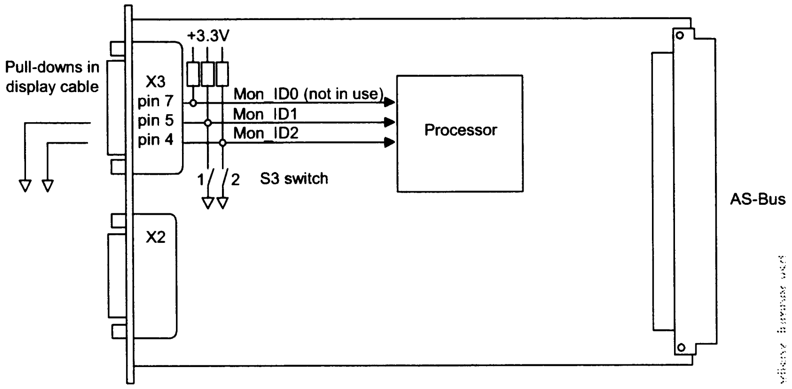


Figure 23 Resolution selection logic, B-DISPX rev.00

NOTE: If the automatic resolution detection for D-LCC10A/W is used, the dip switch S3's both switches must be in off-position (AUTO mode).

NOTE: The resolution detection system does not work with Y-Cable 889314, because MON_ID0-2 lines are connected through the cable. If the display drives these lines, the detection system can fail.

Older version Y-cable 882320 can be used, because in that version MON_ID0-2 lines are not connected.

3.7 S/5 Remote Controller, K-REMCO

Connection to Central Unit

Connect the Remote Controller cable to the X3 connector on the Display Controller, B-DISP/ B-DISPX. Tighten the finger screws.

3.8 S/5 Airway Modules

3.8.1 S/5 Compact Airway Modules, E-xxxx / M-xxxxx

This chapter provides information for installing Compact Airway Modules E-xxxxx.

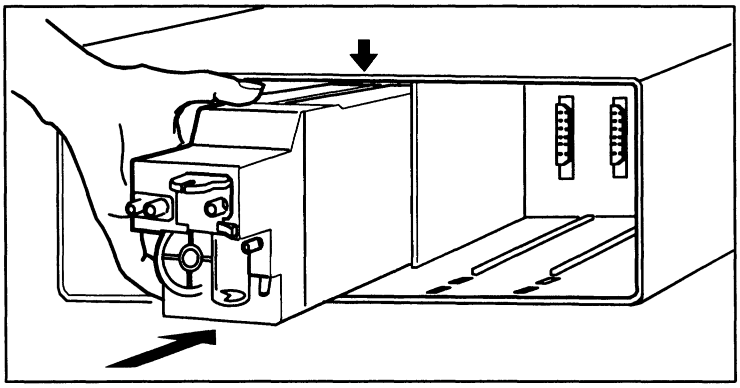


Figure 24 Compact Airway Module, E-XXXX

Connection to Central Unit

1. Ensure that the module is properly orientated (i.e. module release latch facing downward).
2. Align the module insertion guide slot with the insertion guide.
3. Push the module into the frame until it clicks.

NOTE: The Compact Airway Modules cannot be placed into the third and fourth slot from the right-hand side of the Central Unit F-CU8.

3.8.2 S/5 Airway Modules, G-XXXX, with Central Unit F-CU8 only

This chapter provides information for installing Airway Modules G-O, G-OV, G-AO, G-AiO, G-AOV and G-AiOV.

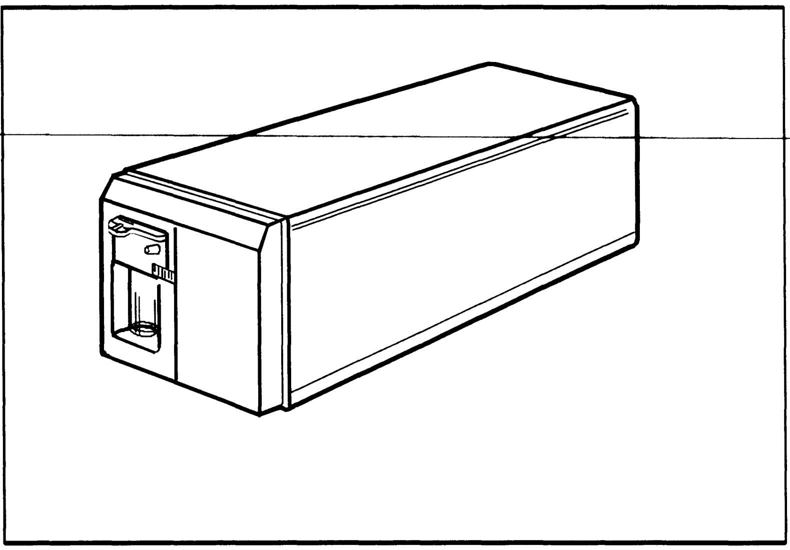


Figure 25 Airway Module, G-XXXX

Connection to Central Unit

1. Make sure that the power to the Central Unit is turned off.
2. Connect the Gas Interface Cable to the X2 connector on the Gas Interface Board, B-GAS, or Interface Board, B-INT, and to the corresponding connector on the rear of the Airway Module.

NOTE: The Gas Interface Board, B-GAS and Interface Board, B-INT are exclusive and cannot be used simultaneously in the same system.

3.8.3 Sample gas exhaust

Preventing operation room pollution

When N_2O or volatile anesthetics are used, pollution of the operation room by these gases should be prevented. Connect the sample gas outlet of the monitor to the scavenging system or return it to the patient circuit.

NOTE: The sample gas from the E-MiniC can only be connected to the scavenging, not returned to the patient circuit.

Connect the sample gas outlet of the monitor to the scavenging system either

- through the ventilator, or
- directly to the vacuum scavenging system.

CAUTION Strong scavenging suction may change the operating pressure of the Airway Module and cause inaccurate readings or internal damage. To prevent this, there must for example be an opening to room air.

Connect the sample gas outlet only to open scavenging system where gas is removed in room pressure.

Scavenging through the ventilator reservoir

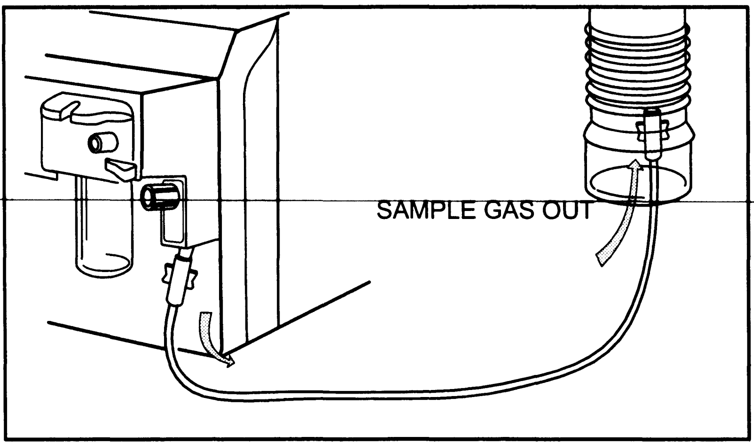


Figure 26 Scavenging through ventilator reservoir

1. Connect an exhaust line to the sample gas outlet on the module's front panel.
2. Attach the other end of the line to the ventilator reservoir. Make sure that the reservoir tube diameter is at least 2 - 3 times larger than the exhaust line.

Scavenging through the anesthesia gas scavenging system

Anesthesia machines are equipped with an anesthesia gas scavenging system (AGSS), and in some machines the sample gas outlet can be connected directly to that.

For example, connect the sample gas outlet to the S/5 Avance:

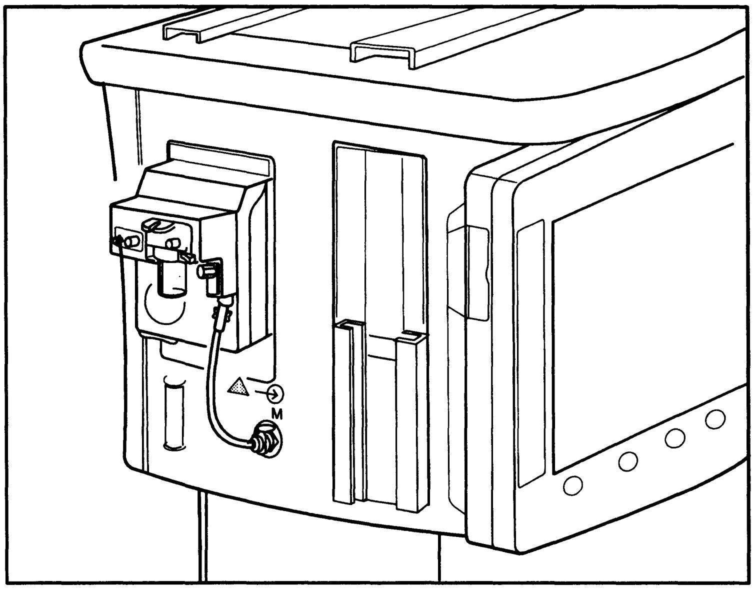


Figure 27 Connecting the gas module to the scavenging connector of S/5 Avance

Note: Refer to the anesthesia machine's documentation to find out where and how the sample gas can be connected.

Connecting directly to the vacuum scavenging system

1. Connect the exhaust line to the monitor's sample gas outlet.
2. Connect the exhaust line only to an open scavenging system where gas is removed at room pressure. Do not connect the monitor directly to a vacuum scavenging system.

Returning sampling gas to the patient circuit

The sampling gas can also be returned to the patient circuit. If you use the S/5 Anesthesia Delivery Unit (ADU), you need an optional adapter connected to the patient breathing tubes.

Take special care when returning sample gas to the patient circuit. For further information, please contact your Datex-Ohmeda distributor.

NOTE: If E-miniC is being used do not return the sample gas to the patient circuit

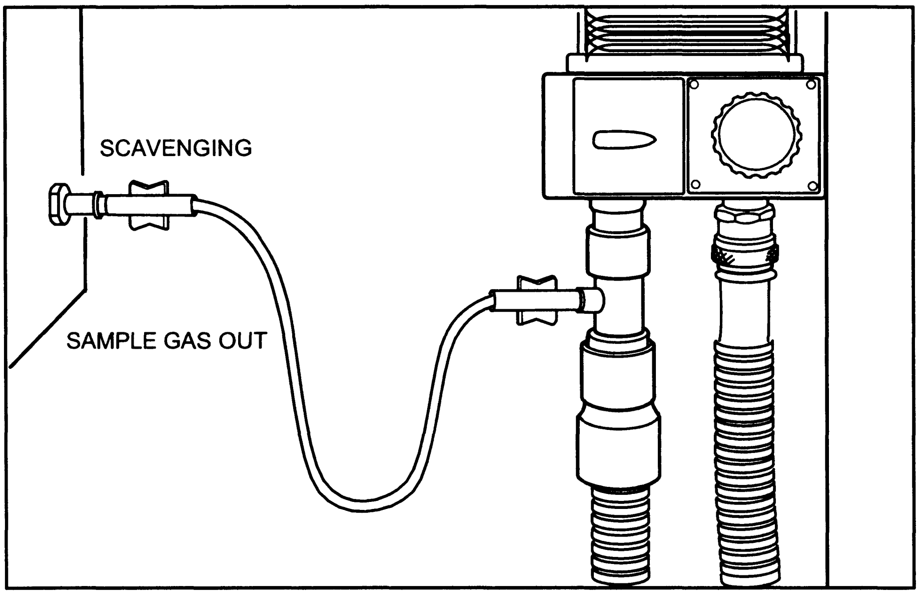


Figure 28 **Sample gas returned to patient circuit in ADU**

3.9 Record Keeping Keyboard for Anesthesia, K-ARKB

3.9.1 Connection to Central Unit

1. Make sure that the power to the Central Unit is turned off.
2. Connect the keyboard-monitor cable to the X2 connector on the Keyboard Interface Board, B-ARK, and to the connector on the rear of the keyboard. Alternatively you can connect the cable to a Display Controller Board, B-DISP or B-DISPX. Secure the connection with the thumbscrew and slip the cable beneath the fasteners.

3.9.2 Connection to LCD Display, D-LCC10A/W and D-LCC12A

1. Make sure that the power to the Central Unit is turned off.
2. Connect the Keyboard-LCD Display Cable to the K-ARKB connector on the LCD Display and to the connector on the rear of the keyboard. Secure the connection with the thumbscrew and slip the cable beneath the fasteners.

3.10 ARK Barcode Reader, N-SCAN (optional)

3.10.1 Connection to Central Unit/LCD Display, D-LCC10A/W or D-LCC12A

The ARK Barcode Reader, N-SCAN, can be connected to the Record Keeping Keyboard for Anesthesia, K-ARKB, and to the LCD Display, D-LCC10 rev. 03 or higher, D-LCC10A/W or D-LCC12A using a Y-cable as illustrated in Figure 29 below.

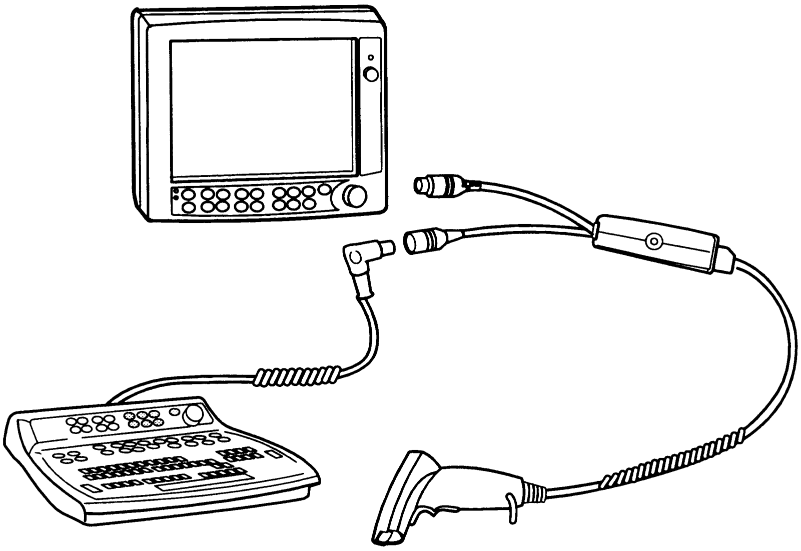


Figure 29 Barcode Reader connected to LCD Display

The ARK Barcode Reader, N-SCAN, can be connected to the Record Keeping Keyboard for Anesthesia, K-ARKB as illustrated in the Figure 30.

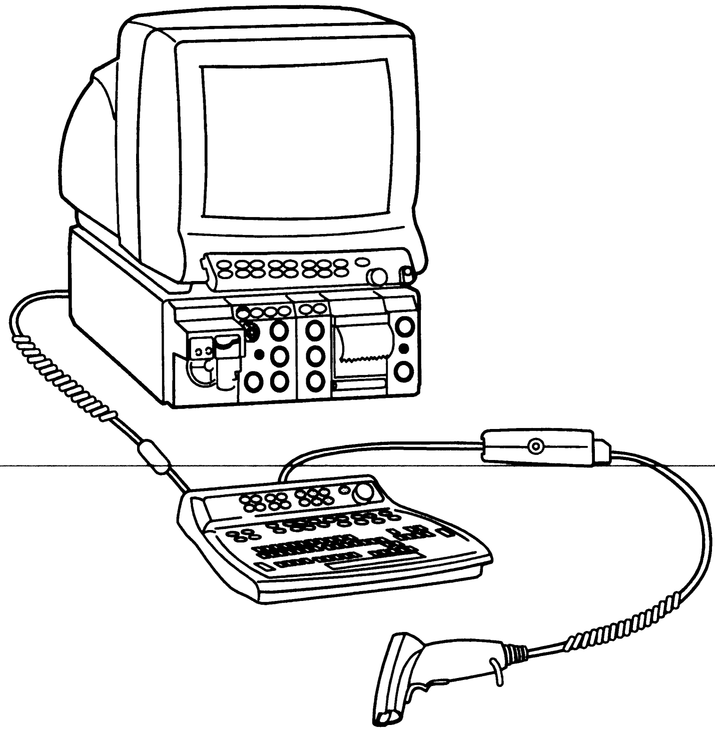


Figure 30 N-SCAN Barcode Reader connection directly to the keyboard

Barcode Reader is configured compatible to your monitor and necessary information is delivered with the monitor.

WARNING **When using the ARK Barcode Reader, N-SCAN, do not stare into beam.**
The N-SCAN is a Class 2 laser product.

3.11 S/5 Extension Frame, F-EXT4, with F-CU8 only

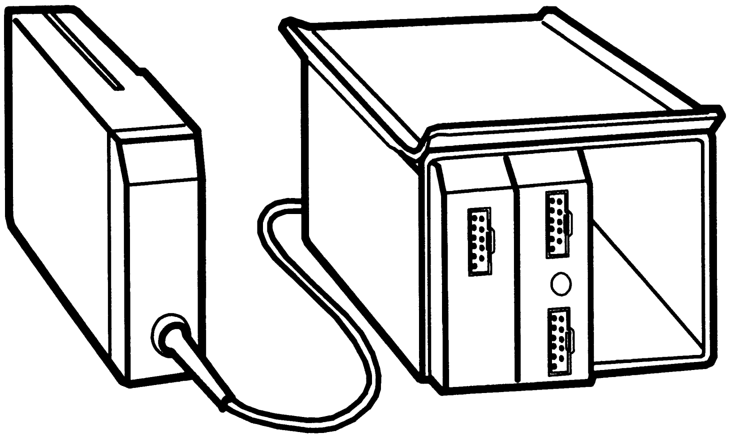


Figure 31 S/5 Extension Frame, F-EXT4

The Extension Frame, F-EXT4, enables the monitor system to be expanded using additional parameter modules. The Extension Frame is connected to the Central Unit via the Extension Module, E-EXT/ M-EXT. The Extension Module plugs into the Central Unit, F-CU8 in the same way as the parameter modules.

NOTE: Only one Extension Frame can be connected to each Central Unit, F-CU8.

3.11.1 Mounting of Extension Frame, F-EXT4

When mounting the Extension Frame, F-EXT4, for instance to an IV pole, make sure that this does not affect the stability of the IV pole.

3.11.2 Connection to Central Unit

Insert the Extension Module, E-EXT/ M-EXT, into the Central Unit. Firmly press the module into position. Connect the Extension Module cable to the Extension Frame.

3.11.3 Inserting parameter modules

Insert the parameter modules into Extension Frame slots. Firmly press the modules into position.

CAUTION Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.

NOTE: Parameter modules with identical functions must not be used simultaneously in the same monitor system. Take special care not to do this when using the Extension Frame.

NOTE: Modules E-REC/ M-REC, E-MEM/ M-MEM, E-INT/ M-INT, E-CXXXX/ M-CXXXX cannot be used in the Extension Frame.

3.11.4 Troubleshooting

If a problem occurs during a functional examination, check the components of the monitor according to the following troubleshooting chart. If the problem persists, please refer to Part II of this Technical Reference Manual.

Trouble	**Treatment**
Nothing functions.	Unplug the Command Board or Remote Controller cable. Check that the cable is intact then reconnect the cable. Unplug the power cord. Check that the cord is intact, then reconnect the cord. Check that the fuses are intact.
The display does not function.	Unplug the display power cord and the display cable. Check that the cord and cable are intact, then reconnect the cord and cable. Unplug the Monitor-LCD Display cable. Check that the cable is intact and reconnect the cable. Check that the display brightness is adjusted properly.
A parameter module does not function.	Remove and replace the module. Check that the parameters displayed are configured correctly.
The Airway Module does not function.	Check that the 'Occlusion' or 'Calibrating Gas Sensor' messages are not displayed. Check that a D-fend water trap and a sampling line are attached. Check that the Gas Interface Board, B-GAS, or Interface Board, B-INT, is inserted properly. Check that the parameters displayed are configured correctly. Press and hold the Select Agent key for three seconds. Turn off the power to the Central Unit. Unplug the Gas Interface Cable. Check that the cable is intact, then reconnect the cable. Turn on the power to the Central Unit.
Compact Airway Module does not function.	Remove and replace the module.

4 Interfacing

External devices can be interfaced with the S/5 Anesthesia and Critical Care Monitors via the UPI4 and UPI4NET boards, B-UPI4 and B-UPI4NET, via the Interface Board, B-INT (only in F-CU8) and via the Interface Module, E-INT / M-INT, and via the Device Interfacing Solution, N-DISxxx.

A UPI4 and UPI4NET board can be used for interface with:

- S/5 Anesthesia Delivery Unit
- Printers
- Computers

An E-INT / M-INT and B-INT can be used for interface with:

- Datex-Ohmeda monitors
- Various other manufacturers' monitors
- Various anesthesia machines

Printers and computers can be interfaced via the monitor's serial or parallel port.

Device specific N-DISxxx modules can be used with:

- Ventilators/ anesthesia machines
- Heart-lung machines
- Monitors
- Blood-gas analyzers

4.1 Interfacing external monitors via Interface Module, E-INT / M-INT, or Interface Board, B-INT

It is possible to interface Datex-Ohmeda monitors, Critikon Dinamap 1846SX, Abbott Oximetrix 3, Baxter Explorer and Vigilance, Nellcor N-100, N-200 and N-1000 to the S/5 Anesthesia Monitor or to the S/5 Critical Care Monitor via Interface Board, B-INT or Interface Module, E-INT / M-INT. The parameters that are transferred from external monitors are summarized in tables: Table 1 Transference of parameters, Datex-Ohmeda monitors and Table 2 Transference of parameters, external monitors.

Interface Board, B-INT, includes two serial connectors (X3 and X9) and two serial/analog connectors (X7 and X8) for interfacing with external monitors. The X3 and X9 connectors provide only numerical data, while the X7 and X8 connectors provide both numerical data and analog waveform data. The Interface Module, E-INT / M-INT, has two serial/analog connectors (X7 and X8).

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

NOTE: Use B-INT with F-CU8 only.

Table 1 Transference of parameters, Datex-Ohmeda monitors

Device	Waveforms (analog)	Numerics	Alarms
Cardiocap	E-INT / M-INT -> CO_2	Et&Fi Airway gases, Respiration rate, SpO_2, Pulse rate	None
Capnomac Capnomac II	E-INT / M-INT -> CO_2, Pleth	Et&Fi Airway gases, Respiration rate	None
Capnomac Ultima	E-INT / M-INT -> CO_2	Et&Fi Airway gases, Respiration rate, Spirometry, SpO_2, Pulse rate, Pleth amplitude	CO_2, O_2, Anesthesia agent, Respiration rate, Apnea, Occlusion, SpO_2, Pulse rate.
Normocap 200 Normocap 200 OXY	E-INT / M-INT -> CO_2	Et&Fi Airway gases, Respiration rate	None
Oscar Oscar II Oscar OXY	E-INT / M-INT -> CO_2, Pleth	Et&Fi Airway gases, Respiration rate, SpO_2, Pulse rate, Pleth amplitude	None
Satlite Satlite II Satlite Plus	E-INT / M-INT -> CO_2	SpO_2, Pulse rate, Pleth amplitude	None
Satlite Trans	None	SpO_2, Pulse rate, Pleth amplitude	None

Table 2 Transference of parameters, external monitors

Device	Waveforms	Numerics	Alarms
Critikon Dinamap 1846SX	None	NIBP	None
Abbott Oximetrix 3	None	SvO_2/SaO_2, CO	None
Baxter Explorer	None	C.O., SvO_2, REF, Tblood	None
Baxter Vigilance	None	C.O., SvO_2, C.C.O., Tblood	None
Nellcor N-100 N-200 N-1000	Pleth (analog)	SpO_2, Pulse rate	None

4.1.1 Connecting interface connector cables to Interface Board, B-INT

When waveforms need to be transmitted or when more than one external monitor will be interfaced to the S/5 Anesthesia Monitor or S/5 Critical Care Monitor, one or more Interface Connector Cables must be used. Connect the cables according to the following procedure. Refer to Figure 32.

1. Connect the 9 pin IDC-type connector to the corresponding connector on the Interface Board, B-INT. Ensure that pin 1 is nearest the edge of the board.

2. Slide the cable trough a U-shaped slot in the front panel of the Interface Board, B-INT. Use the top slot for connector X8, the middle slot for connector X7 and the bottom slot for connector X9.

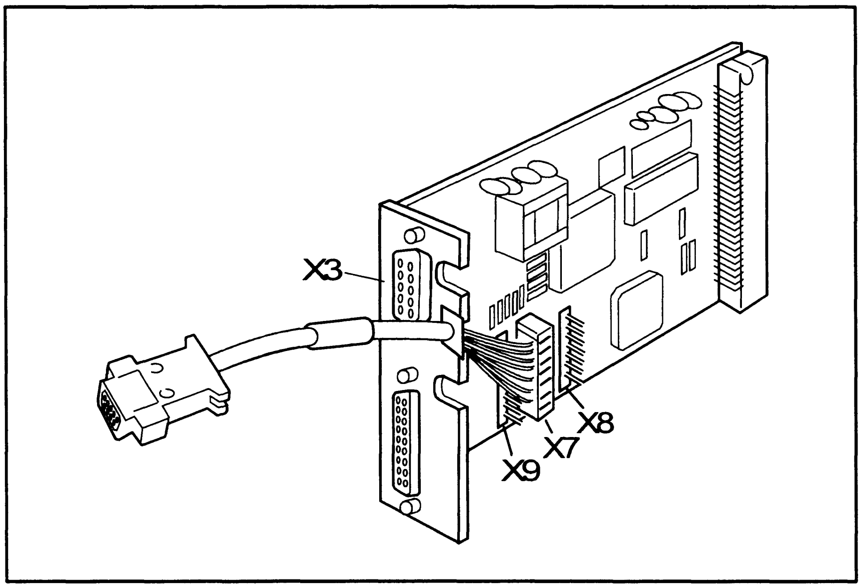


Figure 32 Connecting the interface connector cables to Interface Board, B-INT

WARNING **Interface Module, E-INT / M-INT, and Interface Board, B-INT, cannot be used simultaneously in the same system. If both of them are connected, the monitor may disregard interfaced information.**

4.1.2 Connection to external Datex-Ohmeda monitors

Use the INT-External Device Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the X3, X7, X8 or X9 connector on Interface Board, B-INT, or Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the 25 pin D-connector to the corresponding connector on the other monitor. Tighten the finger screws.

4.1.3 Connection to Critikon Dinamap 1846SX, Abbott Oximetrix 3 and Baxter Explorer

Use the INT-External Device Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the X3, X7, X8 or X9 connector on Interface Board, B-INT, or Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the 25 pin D-connector to the connector on the external monitor. Tighten the finger screws.

4.1.4 Connection to Baxter Vigilance

Use the INT-Baxter Vigilance Cable.

1. Make sure that the power to both monitors is turned off.

2. Connect the 9 pin D-connector to the X3, X7, X8 or X9 connector on Interface Board, B-INT, or Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the other 9 pin D-connector to a corresponding connector on the external monitor. Tighten the finger screws.

Communication parameters are: baud rate 19200, no parity (none), data bits 8, stop bits 1. Mode of communication port: IFM out.

4.1.5 Connection to Nellcor N-100 and N-1000

Use the Monitor-Nellcor Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the X3, X7, X8 or X9 connector on Interface Board, B-INT, or Interface Module, E-INT / M-INT. Tighten the finger screws.

NOTE: The X3 and X9 connectors cannot be used when interfacing the S/5 Anesthesia Monitor or the S/5 Critical Care Monitor with Nellcor N-100 monitors.

3. Connect the other connector to the corresponding connector on the external monitor. Tighten the finger screws. Connect also the mono connectors on the external monitor.

4.1.6 Connection to Nellcor N-200

Use the Monitor-Nellcor Cable.

1. Make sure that the power to both monitors is turned off.
2. Connect one of the connectors to the corresponding connector on Interface Board, B-INT, or Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the other connector to the corresponding connector on the external monitor. Tighten the finger screws. Connect also the mono connectors on the external monitor.
   Connect also the mono connectors on the external monitor.

4.2 Interfacing external bedside devices via S/5 Device Interfacing Solutions, N-DISxxx

The Device Interfacing Solution, N-DISxxx provides means for transferring physiological, waveform and event data from various bedside patient care devices to the Datex-Ohmeda monitoring system. The real-time and trended data can be displayed on the monitor screen and used for record keeping purposes. The interfacing module reads the data coming from the external device, converts it to a suitable format and sends it to the monitor. With the Device Interfacing Solution, N-DISxxx, you can interface up to ten different devices simultaneously.

See the following table of DIS modules and devices that you can interface with the Device Interfacing Solution.

NOTE: The Device Interfacing Solution (DIS) is only compatible with the S/5 Anesthesia and S/5 Critical Care Monitor when the monitor has B-UPI4(NET) and S/5 Monitor software of rev. 01 or later installed.

Table 3 DIS modules and interfaced devices

	Device Ventilators	
N-DISEV4	Evita 4[1]	
N-DISPRIM	Primus[1.]	NOTE: Not available in the US
N-DIS7200	7200 Series Ventilator System[2]	
N-DIS840	840 Ventilator System[2.]	
N-DISS300	Servo Ventilator 300 [3]	
N-DIS7900	Datex-Ohmeda SmartVent 7900[4]	
N-DISAEST	Aestiva/5[4.]	
N-DISVENT	S/5 Aespire[4.] Aestiva/5[4.] Aisys Carestation[4.] S/5 Avance[4.] Centiva/5[4.] Engström Carestation[4.]	

1. Trademark of Dräger Medical AG & Co
2. Trademark of Nellcor Puritan Bennet Inc
3. Trademark of Maquet Critical Care AB part of the Getinge Group (previously trademark of Siemens)
4. Trademark of GE Healthcare Finland Oy

	Device Monitors	
N-DISOXIM3	Oximetrix 3[1]	
N-DISQVUE	QVue /Q2[1.]	
N-DISA2000	A-2000 Bispectral Index Monitoring System[2]	
N-DISVIGIL	Baxter-Vigilance[3]	
N-DISPICCO	PiCCO-Technology[4]	NOTE: Not available in the US

N-DISRGM	RGM Monitor[5]
N-DISTONO	Tonocap[5]
N-DISWHITE	Capnomac, Capnomac II[5] Multicap, Normocap, CD2-02[5] Capnomac Ultima[5] Normocap CD-200[5] Oscar Oxy, Cardiocap 1GS, Cardiocap 2GS[5] Satlite, Satlite Trans, Satlite Plus[5]

1. Trademark of Hospira Inc. (previously trademark of Abbott Laboratories)
2. Trademark of Aspect Medical Systems
3. Trademark of Edwards Lifesciences Corporation
4. Trademark of Pulsion Medical Systems
5. Trademark of GE Healthcare Finland Oy

	Device Blood gas analyzers
N-DISOPT	AVL Opti CCA[1]
	Device Heart-lung machines
N-DISHL20	Jostra HL-20[2]

1. Trademark of Diamond Diagnostics Inc
2. Trademark of MAQUET GmbH & Co. KG part of the Getinge Group

For specific information on parameters transferred from the interfaced device to the Datex-Ohmeda monitor and the applicable software versions of the device refer to the Installation guide accompanying each DIS module.

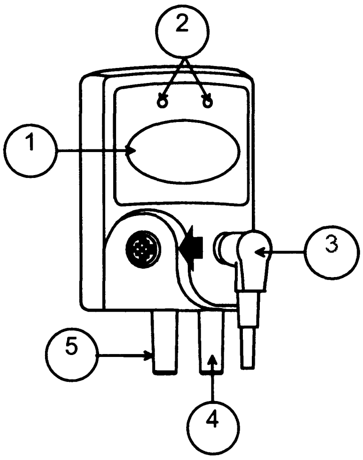
4.2.1 Device Interfacing Solution components

The Device Interfacing Solution consists of:

- a device specific interfacing module
- ~~a device specific cable~~
- a bus cable
- a connector for another bus cable
- label specifying the external device

4.2.2 Connections

Connect the device specific cable to the external device and the bus cable to the S/5 Anesthesia / Critical Care Monitor's UPI4 or UPI4NET board or to the monitor's DIS connector or to another interfacing module.



(1) label specifying the external device
(2) LED indicators
(3) black bus cable from another interfacing module, if needed
(4) grey device specific cable to the communication port of the external device
(5) black bus cable to the monitor's DIS connector (or to another interfacing module)

Figure 33 Connection cables and LED indicators

WARNING **The S/5 Anesthesia/Critical Care Monitor, interfacing modules and interfaced devices must be situated in the same patient environment (as defined in IEC 60601-1-1).**

WARNING **Connecting electrical equipment together or using the same extension cord for more than one device may cause their leakage currents to exceed the limits specified in relevant safety standards. Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

WARNING **The manufacturer guarantees a reliable functioning of the devices with tested software versions only. Always refer to the Installation guide accompanying the DIS module and verify the compatibility before use.**

4.2.3 Mounting

The DIS module can be mounted on the side panel of the external device. Also IV pole placement is possible.

NOTE: As the Device Interfacing Solution works only with the device specified in the label of the interfacing module, it is recommended that the interfacing module always travels along with the external device.

For mounting accessories, please refer to the "Supplies and Accessories" catalog. See the figure below for an example of a device interfacing.

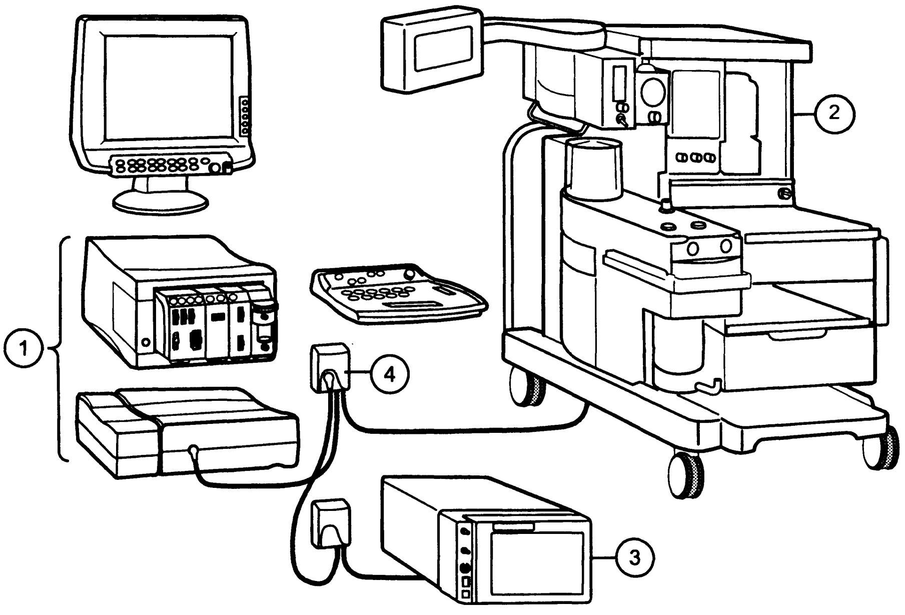


Figure 34 An example of interfacing external devices with Device Interfacing Solution

(1) Datex-Ohmeda S/5 Anesthesia Monitor (with software L-ANE01(A) or later)
(2) Aestiva/5 anesthesia machine
(3) RGM monitor
(4) Interfacing module

NOTE: You can connect up to ten (10) interfacing modules to one system simultaneously.
Check the maximum number of modules: one meter cable = max. ten modules, three meter cable = max. three modules, six meter cable = one module.

CAUTION Make sure that the interfacing module is always used in vertical position to prevent water from entering the module.

CAUTION Make sure that you are connecting the interfacing module to the device specified in the label.

4.2.4 Selecting the external device

1. Turn off the external device.
2. Connect the interfacing module to the monitor's UPI4(NET) board or to the connector for S/5 DIS or to another interfacing module.
3. Connect the device specific cable to the external device and turn the external device on.
4. The monitor identifies the connected device automatically.

4.2.5 Functional check

There are two ways to Check the function of the S/5 Device Interfacing Solution:

1. Press the **Monitor Setup** key.
2. Select ***Interfacing*** and open the ***Status Page*** menu. The status page shows you the current communication status of the interfacing module (1 - 10).

NOTE: The status message 'Connected' appears on the Status Page after you have connected the external device to the interfacing module and turned it on. Note also that the monitor and the interfacing module must be operational.

- Check the LED indicators on the interfacing module (the green LED indicates physical connections, the yellow LED software selections)

GREEN	YELLOW	INDICATION
lit ●	dark ○	Physical connections between the monitor, interfacing module and external device are in order and the device has been selected in the menu.
dark ○	lit ●	There is something wrong with the physical connections between the monitor, interfacing module and external device. The external device has not been selected in the menu.
lit ●	lit ●	Physical connections between the monitor, interfacing module and external device are in order but the external device has not been selected in the menu.
dark ○	dark ○	The interfacing module is not connected to the monitor.

4.2.6 Selecting the parameter data source

Select the external device via **Monitor Setup** - ***Interfacing*** menu:

- Select the desired parameter, for example ***Gases.***
- Select the desired source by name, for example ***Aestiva***.

NOTE: The name of the device is visible on the list only if the device is correctly connected.

NOTE: Detailed information about interfacing module related mountings, connections and settings is included in the installation guides that are delivered with the interfacing modules.

4.3 Interfacing Datex-Ohmeda Anesthesia Delivery Unit

It is possible to interface the Datex-Ohmeda Anesthesia Delivery Unit to the S/5 Anesthesia Monitor via the UPI Board, B-UPI4 or UPINET Board, B-UPI4NET. The data link is bi-directional. The parameters transferred to the Anesthesia Delivery Unit are summarized in Table 4 and the events transferred to the S/5 Anesthesia Monitor are summarized in Table 5. The events are transferred continuously once a minute or during the system check procedure and appear in the trend pages or in the anesthesia record. The transfer of events requires record-keeping software.

4.3.1 Interconnection

Use the ADU-AS/3 Monitor Cable.

4.3.2 Setting interfacing parameters on the S/5 Anesthesia Delivery Unit

1. Press the **Setup** key.
2. Select ***Install*** password 10.
3. Select ***Interfacing*** and choose S/5 AM.
4. Press the **Normal Screen** key.

4.3.3 Setting interfacing parameters on the S/5 Anesthesia Monitor

No settings are required on the S/5 Anesthesia Monitor.

Table 4 Parameters transferred from S/5 Anesthesia Monitor to S/5 Anesthesia Delivery Unit

Waveforms	Numerics
CO_2	Et & Fi CO_2 % Et & Fi O_2 % O_2% difference (I-E) Et & Fi N_2O% Et & Fi AA% Vol Exp MV Vol Exp TV

Table 5 Events transferred from S/5 Anesthesia Delivery Unit to the S/5 Anesthesia Monitor

Events transferred once a minute	
Ventilator settings	Ventilation (mode) Tidal Volume Minute Volume Resp. Rate I:E Times: inp I:E Times: exp InspPause
Ventilator measurements	Ppeak Pplat Peep Pmin
Fresh gas settings	Agent name Agent % in fresh gas Total flow O_2 flow N_2O flow Air flow
Events transferred during system check	
System check test results	Gas Delivery: Agent Gas Delivery: N_2O Leak Tests: AUTO AUTO Leak (ml/min) Leak Test: MAN MAN Leak (ml/min) Number of confirmed checklist items Bypass Check

4.4 Interfacing Dräger Cicero, Cato, Julian and Narkomed 2C (by NAD)

It is possible to interface Dräger Cicero and Cato to the S/5 Anesthesia Monitor or to the S/5 Critical Care Monitor via the Interface Board, B-INT (F-CU8 only), or Interface Module, E-INT / M-INT.

NOTE: The Interface Board must be equipped with revision 881652-4.0 software or later.

The parameters transferred to the S/5 Anesthesia Monitor or S/5 Critical Care Monitor are summarized in Table 6 and Table 7.

NOTE: Some of the summarized parameters (waveforms or numerics) may not be available in all device versions.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

4.4.1 Interconnection

Use the INT-External Device Cable, except for Julian and Cicero EM, in which case use the INT-Julian/Cicero EM cable.

1. Make sure that the power to both monitors is turned off.
2. Connect the 9 pin D-connector to the X3, X7, X8 or X9 connector on Interface Board, B-INT, or Interface Module, E-INT / M-INT. Tighten the finger screws.
3. Connect the 25 pin D-connector to a corresponding connector on the anesthesia machine. The connector is labeled 'RS-232-C'. Tighten the finger screws.

4.4.2 Setting communication parameters

Set the communication parameters for Cicero and Cato to RS-232: 9600, e, 8, 1 (MEDIBUS 3.00). In all cases please refer to the documentation provided by Dräger.

4.4.3 Setting interfacing parameters on the S/5 Anesthesia or Critical Care Monitor

1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** (password 16-4-34)
3. Select ***Service*** (password 26-23-8) - ***Parameters - More...***
4. Select ***Interface*** and combine a required parameter with the external monitor. Two letters, al, denote alarm integration. The selection will be automatically stored in permanent memory.
5. Press the **Normal Screen** key.

Table 6 Parameters transferred from Dräger Cicero monitor to S/5 Anesthesia Monitor or S/5 Critical Care Monitor

Selection	**Waveforms**	**Numerics**	**States**
Gases / SSS	CO_2 (kPa, mmHg, %)	CO_2 Fi & Et (kPa, %) O_2 Fi & Et (%) N_2O Fi & Et (%) RR (CO_2) (1/min) AA Fi & Et (%) Tidal Volume insp. (1) Minute Volume exp. (1)	None
		Ppeak (mbar) Pplat (mbar), PEEP (mbar)	
SpO_2	Pleth (% full scale)	SpO_2 (%) Pulse rate (1/min)	Probe Off

Table 7 Parameters transferred from Dräger Cato, Julian and Narkomed 2C (NAD) monitor to the S/5 Anesthesia Monitor or S/5 Critical Care Monitor

Selection	Waveforms	Numerics	States
Gases / SSS	CO_2 (kPa, mmHg, %)	CO_2 Fi & Et (kPa, %) O_2 Fi & Et(%) N_2O Fi & Et (%) RR (CO_2) (1/min) AA Fi & Et (%) Tidal Volume insp. (1) Minute Volume exp. (1) Ppeak (mbar) Pplat (mbar); not in Narkomed 2C PEEP (mbar)	None
SpO_2	Pleth (% full scale)	SpO_2 (%) Pulse rate (1/min)	Probe Off

NOTE: The transference of parameters illustrated in Table 4 and Table 5, represents the maximum. Some of these parameters may not be available in all device versions.

NOTE: The transference of waveforms requires the MEDIBUS real-time extension and, in Cato monitors, waveforms are available only on port 1.

4.5 Interfacing printer

It is possible to interface a laser printer (either serial or parallel) to the S/5 Anesthesia Monitor and S/5 Critical Care Monitor via the UPI Board, B-UPI4 or UPINET Board, B-UPI4NET. The printer must be PCL5 or PCL6 compatible and it should contain at least 2Mb of memory.

4.5.1 Interconnection

Use a commercial serial printer interface cable or the UPI4 - Printer parallel interface cable 713701 or a standard parallel port printer cable for connecting the printer to the monitor.

1. Make sure that the power on both units is turned off.
2. Connect the cable to the corresponding connector on the B-UPI4(NET).
3. Connect the cable to the corresponding connector on the printer.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

WARNING **Connecting the power supply cord of the printer to the wall power outlet may cause the printer leakage current to exceed the limit specified for medical equipment. Always connect the printer to an appropriate separating transformer.**

4.5.2 Setting interfacing parameters on the printer

NOTE: For more information about printer settings, please refer to the documentation provided with the printer.

4.5.3 Setting interfacing parameters on the S/5 Anesthesia or Critical Care Monitor

Select the appropriate printer connection in the ***Record/Print*** menu.

4.6 Interfacing computer

It is possible to interface a computer to the S/5 Anesthesia Monitor and to the Critical Care Monitor. Contact your authorized GE Healthcare distributor for further advice on computer interface.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

WARNING **Connecting the power supply cord of the computer to the wall power outlet may cause the computer leakage current to exceed the limit specified for medical equipment. Always connect the computer to an appropriate separating transformer.**

4.7 Output signals

4.7.1 UPI4 and UPI4NET Board output signals

Analog/ digital output signals on the connectors X4 and X7 can be used for interfacing with other devices. The pin assignments are illustrated in tables/pictures below.

NOTE: Connector X7 on UPI4NET board rev. 01 differs from X7 on UPI4NET board rev. 00.

Table 8 Coding element connector, X4

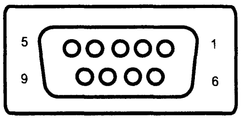
9 pin female D-connector	Pin	Signal
	1	IDCS1 (chip select)
	2	IDCL (clock)
	3	IDDI (data in)
	4	IDDO (data out)
	5	IDPE (protect enable)
	6	+5Vdc
	7	Direct ECG (in B-UPI4NET rev.00 only)
	8	Nurse call
	9	GND

Table 9 Defib & IABP sync connector, X7 (B-UPI4NET rev.01) and on the front of F-CPU

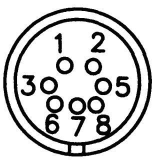
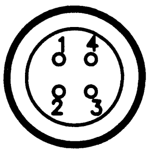
Mini DIN7 connector	Pin	Signal
	1	Defib_sync_out
	2	Reserved
	3	Analog GND
	5	Digital GND
	6	GND
	7	Pressure_out
	8	Direct_ECG_out

Table 10 Synchronization connector, X7 (B-UPI4NET rev.00)

4 pin female connector	Pin	Signal
	1	GND
	2	Def_Sync
	3	Direct ECG
	4	Pressure Out

4.7.2 Digital outputs

The digital output signals are as follows:

Defibrillation Sync B-UPI4NET rev.01 (X7 pin1), B-UPI4NET rev.00 (X7 pin 2)

The defibrillation sync signal is generated by the ECG. When activated, the signal is set to a high level and then set back to a low level after 10 ms. The signal is regenerated only after returning to the low level. The high level ranges from 2.8 to 5 V while the low level ranges from 0 to 0.8 V. The delay from the R wave peak to the start of the signal is 35 ms maximum.

Nurse Call (X4 pin 8)

The Nurse Call signal is generated by the alarms. When activated, the signal is set to the high state and remains at the high state until the alarm situation is over or the SILENCE ALARM key is pressed. The high state range is from 2.8 to 5 V, while the low state range is from 0 to 0.8 V.

If the output signals are used simultaneously with the coding element, the B-UPINET Y-cable, order number 889308, is recommended.

4.7.3 Analog outputs

Direct ECG
B-UPI4NET rev.01(X7 pin 8)

Delay (max.):	15 ms
Gain ECG (out)/ECG (in):	1 V/1 mV
Pacer:	5 V and 2 ms pulse

Direct ECG
B-UPI4NET rev.00(X4 pin 7) and (X7 pin 3)

Delay (max.):	15 ms
Gain ECG (in)/ECG (out):	1 mV/1V

The signal requires input impedance of 100 kΩ.

NOTE: The ECG signal is based on the ECG measurement of the Hemodynamic Modules, M-ESTPR (all variations), M-NES(12)TPR (all variations), E-PRESTN/ M-PRESTN (all variations) and E-PSM / E-PSMP. The ECG signal from the modules is channel 1 (ECG1). The channels 2 and 3 (ECG2, ECG3) are not transmitted. Make sure that the signal in channel 1 (ECG1) is good enough (extensive QRS for IABP synchronization). For further information, please contact your authorized GE Healthcare distributor.

Pressure out
B-UPI4NET rev.01 (X7 pin 7)

Invasive pressure signal: From pressure labelled 'Art'

Delay (max.):	35ms
Gain signal (out) / Pressure (in):	1V/100 mmHg
Pressure area:	-40...320 mmHg

Pressure out
B-UPI4NET rev.00(X7 pin 4)

- P1 from Hemodynamic Module

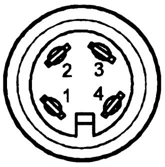
NOTE: With B-UPI4NET rev.00 and monitor software version 03 or earlier, the Invasive pressure output signal is 1 V/100 mmHg, originally ranging from 0 to 300 mmHg.

4.7.4 S/5 Pressure Temp Module, M-PT, output signals

The signal output connector on the Pressure Temp Module, M-PT, can be used to interface some models of IABPs to the S/5 Anesthesia Monitor and S/5 Critical Care Monitor. The pin assignments are illustrated in Table 11. Please contact your local distributor for more information.

WARNING **Always make sure that the combination complies with the international safety standard IEC 60601-1-1 for medical electrical systems and with the requirements of local authorities.**

Table 11 Signal output connector pin assignments

	Pin	Signal
	1	ECG out, ECG1
	2	Pressure out, P3
	3	ECG out, ECG1
	4	Ground

Output signals

ECG out, ECG1	1V / 1mV
Pressure out, P3	1V / 100mmHg
ECG out, ECG1	1V / 1mV

5 Functional check

These instructions include procedures for a functional check for Datex-Ohmeda S/5 Anesthesia Monitor and S/5 Critical Care Monitor. The functional check is recommended to be performed after monitor installation.

These instructions include a "Functional check form" to be filled in when performing the procedures.

The symbol ✍ in the instructions means that the performed procedure should be signed in the check form. The procedures should be performed in ascending order, by passing those that are not applicable for a particular monitor.

All menu selections related to Datex-Ohmeda products are written in following typeface:
e.g. ***Parameters - Gas Unit.***

As you enter the service menus, you need the following passwords:

Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

In case you evaluate the measurement accuracy with a patient simulator, add simulator's accuracy specification to the one of the monitor.

An electrical safety check and a leakage current test are recommended to be performed prior to the monitor installation.

5.1 Recommended tools

For product(s)	**Tool**	**Order No.**
Airway modules		
Compact Airway Module, E-CAiO(VX)/ M-CAiO(VX)	Calibration gas and regulator	755583/755534*
Compact Airway Module, E-COVX/ M-COVX	Calibration gas and regulator	755587/755534*
Compact Airway Module, E-CO(V), M-C, M-CO(V)	Calibration gas and regulator	755581/755534*
Airway Module, G-XXXXX	Calibration gas	755582
Compact Airway Module, E-COVX, E-CAiOVX, M-COVX, M-CAiOVX	Sampling line, 2 m	73318
All Airway modules w/ (V)	Spirometry tube, 2 m	890031
	D-lite	733950
Hemodynamic modules		
Hemodynamic modules w/ (P), M-NIBP	Pressure manometer	
Hemodynamic modules w/ (P)	InvBP transducer	

For product(s)	Tool	Order No.
E-PSM(P)/ E-PRESTN/ M-PRESTN	**Multi-Link ECG accessories, IEC**	
	- Multi-link 3-leadwire set	412682-003
	- Multi-link 5-leadwire set	412681-003
	- Multi-link 5-leadwire set, C2-C6	416467-004
E-PRESTN/ M-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-002
or	**Multi-Link ECG accessories, AHA**	
E-PSM(P)/ E-PRESTN/ M-PRESTN	- Multi-link 3-leadwire set	412682-001
	- Multi-link 5-leadwire set	4162681-001
	- Multi-link 5-leadwire set, V2-V6	416467-003
E-PRESTN/ M-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-001
M-NESTPR	3-lead ECG trunk cable	
	5-lead ECG cable	
M-NESTPR w/ (E12)	10-leadwire ECG cable	
E-PSM(P)/ E-PRESTN	SpO_2 finger probe	OXY-F-UN
	SpO_2 Interconnect Cable	OXY-ES3
M-PRESTN	SpO_2 finger probe	OXY-F4-N or SAS-F4
E-NSAT/ M-NSAT	Nellcor SpO_2 probe	
Hemodynamic modules w/ (T)	Temperature test set	884515
Hemodynamic E-Modules w/ (NIBP)	Adult NIBP cuff hose with cuff ID	2021285-001
	Infant cuff hose without cuff ID	414874-001
Hemodynamic M-Modules w/ (NIBP)	Adult NIBP cuff	572435
	Adult NIBP cuff hose	877235
E-COP/ E-COPSv/ M-COP/ M-COPSv	C.O. Catheter cable	16590
E-COPSv/ M-COPSv	SvO_2 simulator	890121
Tonometry Module, E-TONO/ M-TONO	Calibration gas and regulator	755580/755534*
	Sampling line	733251
	Tonometrics™ catheter	
	Luer plug	
	Pressure manometer	
EEG Module, E-EEG/ M-EEG	Earphones	
	EEG simulator	90502

For product(s)	**Tool**	**Order No.**
BIS Module, E-BIS/ M-BIS	BIS simulator or BIS Sensor simulator	900509 900508
E-ENTROPY/ M-ENTROPY	Entropy simulator	N-ES
	Entropy sensor cable	
E-NMT/ M-NMT	NMT simulator	871251
	M-NMT ElectroSensor	888416
	M-NMT sensor cable	888415
E-MEM/ M-MEM	MemCard - Data or Menu	

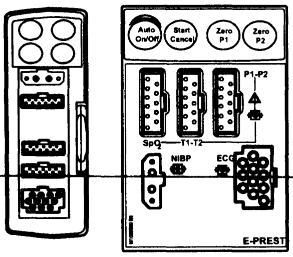
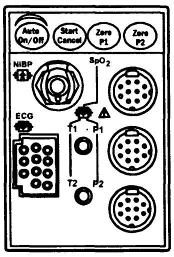
NOTE: * Ensure that the calibration gas and regulator are functioning properly before calibration. Perform annual maintenance on the regulator as required. For more information see section "Adjustments and calibrations" in Compact Airway modules slot.

For details on recommended accessories see "Supplies and Accessories" catalog.

5.1.1 Hemodynamic patient simulators

The following tables present the patient simulators' compatibility with each hemodynamic module, and the accessories needed:

Table 12 Patient simulators' compatibility with each hemodynamic module

		Patient simulator		
Module	**Parameter**	**M1010831**	**MedSim**	**874027**
E-PSM(P), E-PRESTN  Auto On/Off Start Cancel Zero P1 Zero P2 P1-P2 SpO2 T1-T2 NIBP ECG E-PREST	ECG	Ok	Multilink ECG acc.	Not compatible
	T	402015-004	402015-004 and M1010832	
	InvBP	Ok	M1010858	
M-PRESTN  Auto On/Off Start Cancel Zero P1 Zero P2 NIBP SpO2 ECG T1 P1 T2 P2	ECG	Ok	Multilink ECG acc.	Not compatible
	T	Ok	M1010832	M1010832
	InvBP	Not compatible	Ok	Ok

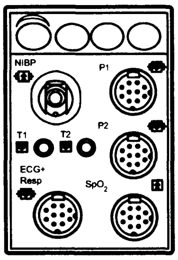
Module	**Parameter**	**Patient simulator**		
		M1010831	**MedSim**	**874027**
M-NESTPR 	ECG	Not compatible	300 series acc.	Ok
	12 lead ECG	Not compatible	300 series acc.	Not compatible
	T	Ok	M1010832	M1010832
	InvBP	Not compatible	Ok	Ok

Table 13 Adapter cables for hemodynamic patient simulators

Patient simulator	**Adapter cables for simulators**	
Hemodynamic patient simulator	- Dual temperature adapter cable	402015-004
Hemodynamic patient simulator	- Dual Inv.BP adapter cable	2005772-001
Medsim	- Temperature adapter cable	M1010832
Medsim	- Inv.BP adapter cable	M1010858
Lionheart & MPS450	- Temperature adapter cable	M1010846
Lionheart & MPS450	- Inv.BP adapter cable	M1010862

5.2 Visual inspection

- Make sure that the monitor is switched to standby.
  Disconnect the mains power cord from the monitor.
  If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable from the monitor. If the Memory Module, E-MEM /M-MEM is connected, remove any memory cards.

1. Check all units visually
   Check that all parts are intact and that the cables and screws are connected and tightened properly. Especially check the following parts:
   - Video displays: the display power cord is locked to the display.
   - F-CU5(P), F-CPU and N-AC: all the screws and the equipotential tap on the N-AC are tightened properly.
   - F-CU8: the equipotential tap and all the screws are tightened properly.
   - sampling line is connected to the Airway Module, if installed

   Check that modules go in smoothly and lock up properly in all module slots.

CAUTION Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.

5.3 Functional inspection

5.3.1 General

1. F-CU5: Connect all the parts together. Check that the cables and screws are tightened properly.
   Connect the mains power cord to the N-AC Power Unit.
   F-CU8: Connect the mains power cord to the F-CU8.
   Check that the stand-by LED is lit.
2. Switch the monitor on.
   Check that the monitor starts up properly, i.e. normal start-up sound is heard from the loudspeaker, the alarm LEDs turn on and off, and the monitoring screen appears.
   No error messages should appear on the screen.
3. Configure the screen for the parameters that are connected.
4. Enter the ***Service Menu***.

   When applicable, check from the corresponding ***Parameters*** submenu that the Timeouts, Bad checksums and Bad c-s by mod values of inserted modules are not increasing faster than by 5 per second. Check also that the module memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.
   If connected, the recorder should record two lines of start-up information.

   Preset measurement settings for those parameters that are connected are, for example:

   Recorder - ***Record Waveforms - Waveform 1 - ECG1***
   - Waveform 2 - P1
   - Waveform 3 - P2

   Invasive Pressures - ***P1 'ART' Setup -- Label – ART***
   - P2 'CVP' Setup -- Label – CVP
   - P3 Setup -Label -PA
   - P4 Setup -Label -P4
   - P5 Setup -Label -P5
   - P6 Setup -Label -P6

   Pulse Oximetry ***-Pleth Scale –AUTO***
   or

   Others ***-SPO2 Setup - Pleth Scale –AUTO***

   Airway Gas ***-Spirometry View -Scaling -Indep.***
   -Paw Scale –20
   -Flow Scale –15
   or

   Ventil.*-Spirometry Setup -Scaling -Indep.*
   -Paw Scale –20
   -Flow Scale –15

   Others ***-Resp Setup -Size -1.0***

   - Resp Rate Source – AUTO
   - Measurement – ON
   - Detection Limit – AUTO

5.3.2 Display(s)

1. Check that the picture on the screen is correct. Readjust the picture with the adjustment knobs or with the display menu keys, if necessary.

5.3.3 Keyboard(s)

1. Tests with all the connected keyboards:
   - Press the **Monitor Setup** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select ***Normal Screen*** and check that the menu disappears from the screen.

   Tests with the Command Bar / Command Board:
   - Press the **Help** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select ***Normal Screen*** and check that the menu disappears from the screen.
     Check the rest of the menu keys by pressing them one by one.

   Tests with the ARK Keyboard:
   - Enter the ***Keyboard*** service menu
   - Check functioning of the ComWheel.
   - Press all keys, except **Modify** and **Print**. Check that each key produces a sound from the loudspeaker, or the Message count value in the service menu increases.
   - Press the **Modify** and **Print** keys and check that the corresponding menus appear on the monitor screen.

   Tests with the Remote Controller:
   - Enter the ***Keyboard*** service menu.
   - Check the function of the ComWheel.
   - Press all keys. Check that each key produces a sound from the loudspeaker, or the Message count value in the service menu increases.

5.3.4 5-Module Central Unit, F-CU5/ 8-Module Central Unit, F-CU8

1. Check that all the fans in the N-AC, F-CPU and F-CU5(P) are / the frame fan in F-CU8 is running.
2. Check that the clock on the screen shows correct time. Readjust the time and date, if necessary.

5.3.5 Extension Frame, F-EXT4

1. If the F-EXT4 contains a fan, check that the fan is running.

2. Check that the modules in the F-EXT4 are recognized i.e. the required parameter information is shown on the monitor screen.

✍

5.3.6 Airway Module, G-XXXX

Wait until the message 'Calibrating gas sensor' disappears from the screen.

1. Check that the Airway Module fan is running.
2. If the module contains a membrane key on the front panel, press the key for at least one second and check that it is identified.

✍

For Airway Modules containing the Patient Spirometry option

3. Connect a clean spirometry tube and D-lite to the module. Connect the sampling line to the D-lite. Breathe through the wider side of the D-lite. Check that the flow waveform moves downwards when you breathe in and upwards when you breathe out.

✍

For all Airway Modules, G-XXXX

4. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
5. Remove the D-fend and check that the message 'Check D-fend' appears on the screen within 30 seconds.
6. Breathe to the sampling line briefly. Check that the CO2 information is updated on the screen.

✍

5.3.7 Compact Airway Module, E-CXXXXX/ M-CXXXXX

Wait until the message 'Calibrating gas sensor' disappears from the screen.

1. Check that the fan is running.
2. If the module contains membrane keys on the front panel, press each of the keys for at least one second and check that they are identified.

✍

Compact Airway Modules with the Patient Spirometry option

3. Connect a clean spirometry tube and D-lite to the module. Connect the sampling line. Breathe through the wider side of the D-lite. Check that the flow waveform moves downwards when you breathe in and upwards when you breathe out.

✍

For all Compact Airway Modules

4. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
5. Detach the D-fend and check that the message 'Check D-fend' appears on the monitor screen within 30 seconds.
6. Breathe to the sampling line briefly. Check that the CO2 information is updated on the screen.

✍

5.3.8 Single width Airway Module, E-miniC/ M-miniC

Wait until the message 'Calibrating gas sensor' disappears from the screen.

1. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
2. Detach the Mini D-fend and check that the message 'Check D-fend' appears on the monitor screen within 30 seconds.

   Breathe to the sampling line briefly. Check that the CO2 information is updated on the screen.

✍

5.3.9 Tonometry Module, E-TONO/ M-TONO

1. Press each of the front panel membrane keys for at least one second and check that they are identified.

✍

5.3.10 Multiparameter Hemodynamic Modules

ECG and RESP measurements

1. Check the function of the front panel membrane key **ECG**, **Lead**, if available.
2. Connect an ECG cable to the module. Connect the cable leads to a patient simulator. Check that all ECG and impedance respiration information is shown on the monitor screen as configured on the simulator.

   Turn the simulator off. Check that the 'Asystole' and 'Apnea' messages are displayed.

✍

Temperature measurement

3. Check the temperature channels with a patient simulator.

   Check that temperature measurement information is shown on the monitor screen as configured on the simulator.

✍

Invasive blood pressure measurement

4. Check the function of the front panel membrane keys.
5. Check the InvBP channels with a patient simulator.
6. Zero the InvBP channels and check that the values and waveforms correspond to the simulator settings.

Sp02 measurement

7. Connect an Sp02 finger probe to the module. Check that the message 'Probe off' is shown when the probe is not connected to a finger.
8. Attach the Sp02 probe to your finger. Check that a reading of 95-99 and a pleth waveform appear on the screen

Non invasive blood pressure measurement

9. Check the function of the front panel membrane keys.
10. Attach an adult NIBP cuff onto your arm and perform one NIBP measurement. Check that the module identifies the cuff, i.e. the text 'Adult' appears in the NIBP digit field for a short time.

    Check that the module gives a reasonable measured result.

5.3.11 Pressure/Pressure Temp Modules, E-P, E-PT, M-P, M-PT

Invasive blood pressure measurement

1. Check the function of the front panel **Zero P3** key.
2. Check the InvBP channel with a patient simulator.

   Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

Temperature measurement

3. Check the temperature channels with a patient simulator.

   Check that temperature measurement information is shown on the monitor screen as configured on the simulator.

5.3.12 Dual pressure Module, E-PP/ M-PP

1. Check the function of the front panel **Zero P5** and **Zero P6** keys.
2. Check the InvBP channels with a patient simulator.

Zero the InvBP channels. Then check that the values and waveforms correspond to the simulator settings.

✍

5.3.13 Cardiac Output Modules, E-COP/ M-COP, E-COPSv/ M-COPSv

Invasive blood pressure measurement

1. Check the function of the front panel **Zero P4** key.
2. Check the InvBP channel with a patient simulator.

   Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

✍

Cardiac Output measurement

3. Check the function of the front panel **Start C.O.** key.

✍

5.3.14 NIBP module, M-NIBP

1. Check the function of the front panel membrane keys.
2. Attach an adult NIBP cuff onto your arm and perform one NIBP measurement.

   Check that the module identifies the cuff, i.e. the text 'Adult ' appears on the NIBP digit field for a short time.

   Check that the module gives a reasonable measured result.

✍

5.3.15 Nellcor Compatible Saturation module, E-NSAT/ M-NSAT

1. Connect a Nellcor SpO2 finger probe to the module. Check that the message 'Pulse search ' is shown. Check also that the shown message changes to 'Check probe ' within 30 seconds.
2. Attach the SpO2 probe on your finger. Check that a reading of 95-100 and a proper SpO2 waveform appear.

✍

5.3.16 Datex-Ohmeda Oxygen Saturation module, M-OSAT

1. Connect an OxyTip ® + Reusable Finger Sensor such as Integrated Finger Sensor OXY-F4-N to the module. Check that the message 'No Probe' in the screen changes to 'Check probe'.
2. Attach the SpO2 probe on your finger. Check that a reading of 95-100 and a proper SpO2 waveform appear.

✍

5.3.17 BIS Module, E-BIS/ M-BIS

1. Connect the BIS module to the monitor frame.

   Check that 'Cable off' is displayed in the BIS waveform field.
2. Connect the DSC to the module.

   Check that the 'No sensor' message appears in the waveform field.
3. Check the function of the front panel membrane keys.
   Open the ***BIS Setup*** menu: **BIS - *BIS Setup*** and check that ***Test DSC*** shows PASS.

   NOTE: If the sensor is not connected, the **Check Sensor** key is inoperative.

5.3.18 Entropy Module, E-ENTROPY/ M-ENTROPY

Check the function of the front panel membrane keys.

Connect the Entropy sensor cable and Entropy simulator to the module. Check that 'Checking sensor' text and an image appear in the waveform numeric field. Wait for a while and check that all sensors show PASS.

Check that the EntrEEG waveform and RE and SE values appear on the monitor screen.

5.3.19 Memory Module, E-MEM/ M-MEM

1. Insert a Data card or a Menu card to the slot.

   Check that the corresponding symbol appears on the monitor screen.

5.3.20 Recorder module

1. Press the **Record Wave** module key and check that the module starts recording the selected waveforms. Press the **Stop** module key to stop recording.
2. Check that the quality of the recordings is acceptable.

5.3.21 Network connection

1. Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect them to the Network/UPI4NET Board.

   Check that the monitor connects to the iNetwork, i.e. the network symbol appears under the clock on the upper right-hand corner of the screen. Also a message regarding the connected Central should appear in the message field on the screen.

5.3.22 Interface Board/Module, B-INT/ E-INT/ M-INT

1. Make sure that the monitor receives all necessary parameter data from the connected devices. Check the screen configuration and the related interfacing settings, if necessary.

   Monitor Setup - ***Interfacing***

   ✍

5.3.23 Device Interfacing Solution, N-DISxxx

1. Make sure that the monitor receives all necessary parameter data from the connected devices. Check the screen configuration and the related interfacing settings, if necessary.

   Monitor Setup - ***Interfacing*** - ***Status Page***

   ✍

5.3.24 General

- Switch the monitor to standby
- Perform final cleaning
- Fill in all necessary documents

✍

6 General troubleshooting

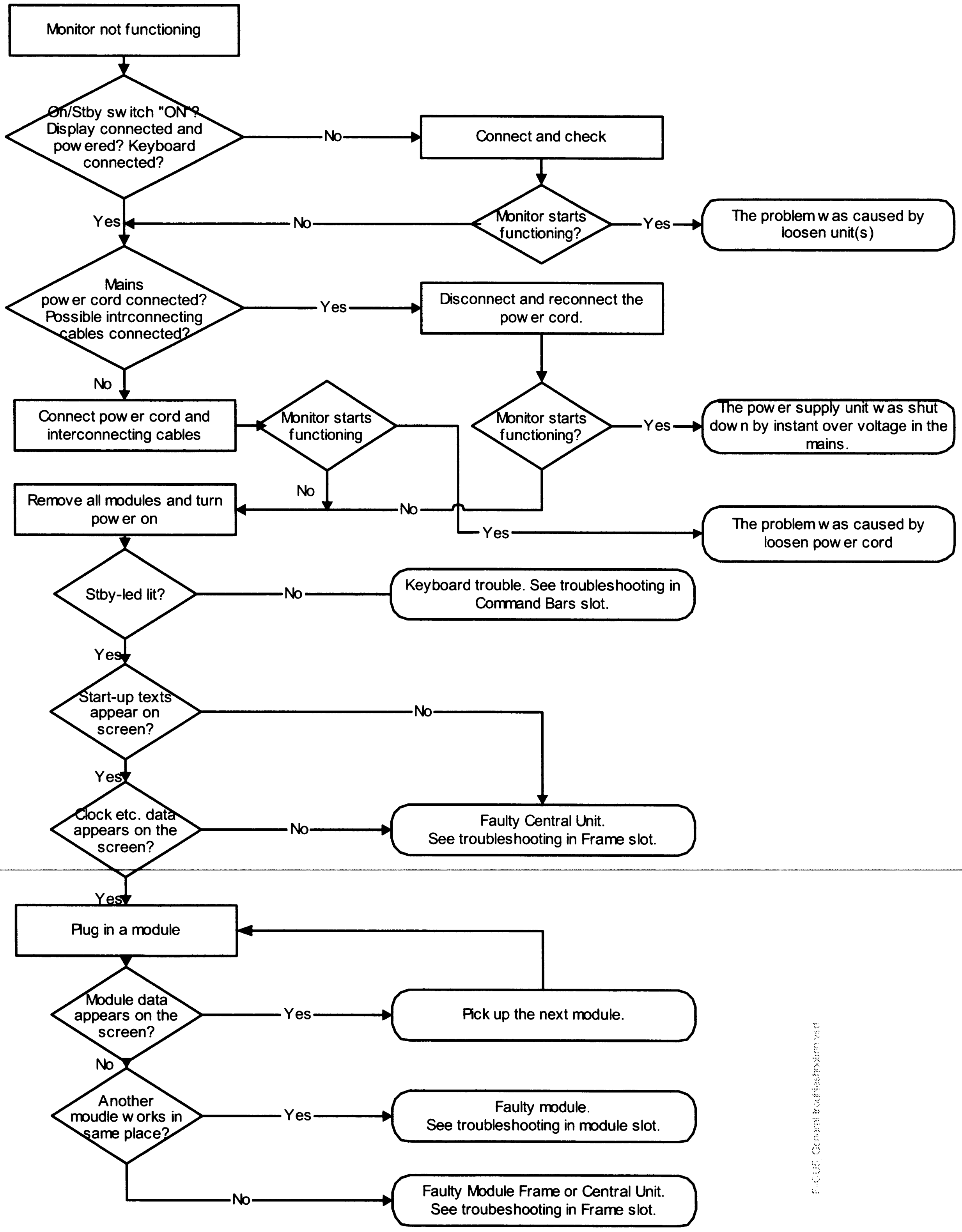

Monitor not functioning
On/Stby switch "ON"? Display connected and powered? Keyboard connected?
No
Connect and check
Monitor starts functioning?
Yes
The problem was caused by loosen unit(s)
No
Yes
Mains power cord connected? Possible intrconnecting cables connected?
Yes
Disconnect and reconnect the power cord.
No
Connect power cord and interconnecting cables
Monitor starts functioning
Monitor starts functioning?
Yes
The power supply unit was shut down by instant over voltage in the mains.
No
No
Remove all modules and turn power on
Yes
The problem was caused by loosen power cord
Stby-led lit?
No
Keyboard trouble. See troubleshooting in Command Bars slot.
Yes
Start-up texts appear on screen?
No
Yes
Clock etc. data appears on the screen?
No
Faulty Central Unit. See troubleshooting in Frame slot.
Yes
Plug in a module
Module data appears on the screen?
Yes
Pick up the next module.
No
Another moudle works in same place?
Yes
Faulty module. See troubleshooting in module slot.
No
Faulty Module Frame or Central Unit. See troubeshooting in Frame slot.

Figure 35 S/5 AM, CCM general troubleshooting flowchart

APPENDIX A Functional check form, Datex-Ohmeda S/5 AM, CCM

Customer	
Service	
Service engineer	Date

Monitor Installation			
F-CU5(P)	B-	N-	
F-CPU	B-		
N-AC	B-		
F-CU8	B-		
L-	K-		
D-	D-		

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

Visual Inspection			**OK**	**N.A.**	**Fail**
1. Check all units visually			☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
5.3.1. General		☐	☐	☐
5.3.2. Display(s)	S/N	☐	☐	☐
5.3.3. Keyboard(s)	S/N	☐	☐	☐
5.3.4. 5-Module Central Unit, F-CU5/ 8-Module Central Unit, F-CU8	S/N	☐	☐	☐
5.3.5. Extension Frame, F-EXT4	S/N	☐	☐	☐
Notes				
5.3.6. Airway Module, G-XXXX	S/N	☐	☐	☐
. For Airway Modules containing the Patient Spirometry option		☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
. For all Airway Modules, G-XXXX		☐	☐	☐
Notes				
5.3.7. Compact Airway Module, E-CXXXXX/ M-CXXXXX	S/N	☐	☐	☐
. Compact Airway Modules with the Patient Spirometry option		☐	☐	☐
. For all Compact Airway Modules		☐	☐	☐
5.3.8. Single width Airway Module, E-miniC/ M-miniC	S/N	☐	☐	☐
Notes				
5.3.9. Tonometry Module, E-TONO/ M-TONO	S/N	☐	☐	☐
Notes				
5.3.10. Multiparameter Hemodynamic Modules	S/N	☐	☐	☐
. ECG and RESP measurements		☐	☐	☐
. Temperature measurement		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Sp02 measurement		☐	☐	☐
. Non invasive blood pressure measurement		☐	☐	☐
Notes				
5.3.11. Pressure/Pressure Temp Modules, E-P, E-PT, M-P, M-PT	S/N	☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Temperature measurement		☐	☐	☐
5.3.12. Dual pressure Module, E-PP/ M-PP	S/N	☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
Notes				
5.3.13. Cardiac Output Modules, E-COP/ M-COP, E-COPSv/ M-COPSv	S/N	☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Cardiac Output measurement		☐	☐	☐
Notes				
5.3.14. NIBP module, M-NIBP	S/N	☐	☐	☐
5.3.15. Nellcor Compatible Saturation module, E-NSAT/ M-NSAT	S/N	☐	☐	☐
5.3.16. Datex-Ohmeda Oxygen Saturation module, M-OSAT	S/N	☐	☐	☐
5.3.17. BIS Module, E-BIS/ M-BIS	S/N	☐	☐	☐
5.3.18. Entropy Module, E-ENTROPY/ M-ENTROPY	S/N	☐	☐	☐
5.3.19. Memory Module, E-MEM/ M-MEM	S/N	☐	☐	☐
5.3.20. Recorder module	S/N	☐	☐	☐
5.3.21. Network connection	S/N	☐	☐	☐
5.3.22. Interface Board/Module, B-INT/ E-INT/ M-INT	S/N	☐	☐	☐
5.3.23. Device Interfacing Solution, N-DISxxx	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
Notes				

Functional Inspection		**OK**	**N.A.**	**Fail**
5.3.24. General		☐	☐	☐
• Perform final cleaning		☐	☐	☐
• Fill in all necessary documents		☐	☐	☐
Notes				

Signature

APPENDIX B ElectroMagnetic Compatibility

Table 1 Guidance and manufacturer's declaration - electromagnetic emissions

<table>
<tr><th colspan="3">Guidance and manufacturer's declaration – electromagnetic emissions</th></tr>
<tr><td colspan="3">The S/5™ AM or CCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ AM or CCM should assure that it is used in such an environment.</td></tr>
<tr><th>Emissions test</th><th>Compliance</th><th>Electromagnetic environment - guidance</th></tr>
<tr><td>RF emissions
CISPR 11</td><td>Group 1</td><td>The S/5™ AM or CCM uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in the nearby electronic equipment.</td></tr>
<tr><td>RF emissions
CISPR 11</td><td>Class B</td><td rowspan="3">The S/5™ AM or CCM (1 is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.</td></tr>
<tr><td>Harmonic emissions
IEC 61000-3-2</td><td>Class A</td></tr>
<tr><td>Voltage fluctuations/ flicker emissions
IEC 61000-3-3</td><td>Complies</td></tr>
<tr><td>RF emissions
CISPR 11</td><td>Class A</td><td rowspan="3">The S/5™ AM or CCM (2 is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.</td></tr>
<tr><td>Harmonic emissions
IEC 61000-3-2</td><td>Class A</td></tr>
<tr><td>Voltage fluctuations/ flicker emissions
IEC 61000-3-3</td><td>Complies</td></tr>
</table>

(1 S/5™ AM or CCM equipped with 8-Module Frame F-CU8.

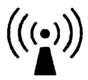
(2 S/5™ AM or CCM equipped with 5-Module Frame F-CU5(P), Power Unit N-AC and Central Processor Unit F-CPU.

Table 2 Guidance and manufacturer's declaration - electromagnetic immunity

<table>
<tr><th colspan="4">Guidance and manufacturer's declaration – electromagnetic immunity</th></tr>
<tr><td colspan="4">The S/5™ AM or CCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ AM or CCM should assure that it is used in such an environment.</td></tr>
<tr><th>Immunity test</th><th>IEC 60601 test level</th><th>Compliance level</th><th>Electromagnetic environment - guidance</th></tr>
<tr><td>Electrostatic discharge (ESD)
IEC 61000-4-2</td><td>±6 kV contact
±8 kV air</td><td>±6 kV contact
±8 kV air</td><td>Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.</td></tr>
<tr><td>Electrical fast transients/bursts
IEC 61000-4-4</td><td>±2 kV for power supply lines
±1 kV for input/output lines</td><td>±2 kV for power supply lines
±1 kV for input/output lines</td><td>Mains power quality should be that of a typical commercial or hospital environment.</td></tr>
<tr><td>Surge
IEC 61000-4-5</td><td>±1 kV differential mode
±2 kV common mode</td><td>±1 kV differential mode
±2 kV common mode</td><td>Mains power quality should be that of a typical commercial or hospital environment.</td></tr>
<tr><td>Voltage dips, short interruptions and voltage variations on power supply lines
IEC 61000-4-11</td><td><5 % U_T (>95 % dip in U_T) for 0.5 cycle
40 % U_T (60 % dip in U_T) for 5 cycles
70 % U_T (30 % dip in U_T) for 25 cycles
<5 % U_T (>95 % dip in U_T) for 5 sec</td><td><5 % U_T (>95 % dip in U_T) for 0.5 cycle
40 % U_T (1 (60 % dip in U_T) for 5 cycles (1</td><td>Mains power quality should be that of a typical commercial or hospital environment. If user of the S/5™ AM or CCM requires continued operation during power mains interruptions, it is recommended that the S/5™ AM or CCM be powered from an uninterruptible power supply or a battery.</td></tr>
<tr><td>Power frequency (50/60 Hz) magnetic field
IEC 61000-4-8</td><td>3 A/m</td><td>3 A/m</td><td>Power frequency magnetic field should be at levels characteristic of a typical location in a typical commercial or hospital environment.</td></tr>
<tr><td colspan="4">NOTE U_T is the a.c. mains voltage prior to application of the test level.</td></tr>
</table>

(1 S/5™ AM or CCM equipped with 5-Module Frame F-CU5(P), Power Unit N-AC and Central Processor Unit F-CPU.

Table 3 Guidance and manufacturer's declaration – electromagnetic immunity

Guidance and manufacturer's declaration – electromagnetic immunity			
The S/5™ AM or CCM is intended for use in the electromagnetic environment specified below. The customer or the user of the S/5™ AM or CCM should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
			Portable and mobile RF communications equipment should be used no closer to any part of the S/5™ AM or CCM, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.2\sqrt{P}$
	3 Vrms 150 kHz to 80 MHz	1 Vrms (1	$d = 3.5\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz
	3 V/m 80 MHz to 2.5 GHz	1 V/m (2	$d = 3.5\sqrt{P}$ 80 MHz to 800 MHz $d = 7.0\sqrt{P}$ 800 MHz to 2.5 GHz
			where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [a] should be less than the compliance level in each frequency range. [b] Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1	At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2	These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.
a	Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicated theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the S/5™ AM or CCM is used exceeds the applicable RF compliance level above, the S/5™ AM or CCM should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the S/5™ AM or CCM.
b	Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m or 1 V/m (1.

(1 For impedance RESP measurement and invasive pressure measurement in M-series modules except M-(P)RE(S)TN. The invasive pressure measurement compliance level is dependent on the transducer used, and only the lower level is guaranteed for all transducers.

(2 For invasive pressure measurement in M-COPSv modules and BIS measurement in E-BIS/ M-BIS and RESP measurement in M-(P)RE(S)TN. The invasive pressure measurement compliance level is depandant on the transducer used, and only the lower level is guaranteed for all transducers.

Table 4 Recommended separation distances between portable and mobile RF communications equipment and the S/5™ AM or CCM

Recommended separation distances between portable and mobile RF communications equipment and the S/5™ AM or CCM .

The S/5™ AM or CCM is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the S/5™ AM or CCM can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the S/5™ AM or CCM as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	**Separation distance according to frequency of transmitter** m		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$ $d = 3.5\sqrt{P}$ (1	80 MHz to 800 MHz $d = 1.2\sqrt{P}$ $d = 3.5\sqrt{P}$ (2	800 MHz to 2.5 GHz $d = 1.2\sqrt{P}$ $d = 7.0\sqrt{P}$ (2
0.01	0.12 0.35 (1	0.12 0.35 (2	0.23 0.70 (2
0.1	0.38 1.1 (1	0.38 1.1 (2	0.73 2.2 (2
1	1.2 3.5 (1	1.2 3.5 (2	2.3 7.0(2
10	3.8 11 (1	3.8 11(2	7.3 22(2
100	12 35 (1	12 35(2	23 70(2

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

(1 For impedance RESP measurement and invasive pressure measurement in M-series modules except M-(P)RE(S)TN. The invasive pressure measurement compliance level is dependant on the transducer used, and only the lower level is guaranteed for all transducers.

(2 For invasive pressure measurement in M-COPSv modules and BIS measurement in E-BIS/ M-BIS and RESP measurement in M-(P)RE(S)TN. The invasive pressure measurement compliance level is dependant on the transducer used, and only the lower level is guaranteed for all transducers.

For your notes:

Datex-Ohmeda

S/5™ Anesthesia Monitor, S/5™ Critical Care Monitor

Planned Maintenance Instructions

All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

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Appendix A: Planned maintenance check form, S/5 Anesthesia Monitor and S/5 Critical Care Monitor A-1

1 Planned maintenance instructions

1.1 Introduction

These instructions include procedures for planned maintenance (PM) for the Datex-Ohmeda S/5 Anesthesia Monitor and S/5 Critical Care Monitor Compact. The Planned maintenance should be performed once a year.

These instructions include "Planned maintenance check form, S/5 Anesthesia Monitor and S/5 Critical Care Monitor" to be filled in when performing the corresponding procedures.

The symbol ✍ in the instructions means that the procedure performed should be signed in the check form.

The procedures should be performed in ascending order, bypassing those that are not applicable for a particular monitor.

If you need further information on how to perform a certain Planned maintenance procedure, please refer to the corresponding slot in the Technical Reference Manual.

All menu selections related to the Datex-Ohmeda monitors are written in the following typeface:

e.g. ***Parameters - Gas Unit***

As you enter the service menus, you need following passwords:

Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

In case you evaluate the measurement accuracy with a patient simulator, add the simulator's accuracy specification to the one for the monitor.

1.2 Recommended tools

For product(s)	Tool	Order No.
All Airway modules	Flowmeter	
Compact Airway Module, E-CAiO(VX),/ M-CAiO(VX)	Calibration gas and regulator	755583/755534*
Compact Airway Module,E-COVX/ M-COVX	Calibration gas and regulator	755587/755534*
Compact Airway Module, E-CO(V), M-C, M-CO(V)	Calibration gas and regulator	755581/755534*
E-miniC/ M-miniC	Calibration gas and regulator	755580/755534*
Airway Module, G-XXXXX	Calibration gas	755582
Compact Airway Module, E-COVX, E-CAiOVX, M-COVX, M-CAiOVX	Sampling line, 2 m	73318
All Airway modules w/ (V)	Spirometry tube, 2 m	890031
All Airway modules w/ (V)	D-lite	733950
Hemodynamic modules		
Hemodynamic modules w/ (P), M-NIBP	Pressure manometer	

For product(s)	**Tool**	**Order No.**
Hemodynamic modules w/ (P)	InvBP transducer	
	Multi-Link ECG accessories, IEC	
E-PSM(P)/ E-PRESTN/ M-PRESTN	- Multi-link 3-leadwire set	412682-003
	- Multi-link 5-leadwire set	412681-003
	- Multi-link 5-leadwire set, C2-C6	416467-004
E-PRESTN/ M-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-002
or	**Multi-Link ECG accessories, AHA**	
E-PSM(P)/ E-PRESTN/ M-PRESTN	- Multi-link 3-leadwire set	412682-001
	- Multi-link 5-leadwire set	4162681-001
	- Multi-link 5-leadwire set, V2-V6	416467-003
E-PRESTN/ M-PRESTN w/ (E12)	- Multi-link 12-lead ECG trunk cable	416035-001
M-NESTPR	3-lead ECG trunk cable	
M-NESTPR	5-lead ECG cable	
M-NE12STPR	10-leadwire ECG cable	
E-PSM(P)/ E-PRESTN	SpO_2 finger probe	OXY-F-UN
	SpO_2 Interconnect Cable	OXY-ES3
M-PRESTN	SpO_2 finger probe	OXY-F4-N or SAS-F4
E-NSAT/ M-NSAT	Nellcor SpO_2 probe	
Hemodynamic modules w/ (T)	Temperature test set	884515
Hemodynamic E-Modules w/ (NIBP)	Adult NIBP cuff hose with cuff ID	2021285-001
	Infant cuff hose without cuff ID	414874-001
Hemodynamic M-Modules w/ (NIBP)	Adult NIBP cuff	572435
	Adult NIBP cuff hose	877235
E-COP, E-COPSv, M-COP, M-COPSv	C.O. Catheter cable	16590
E-COPSv/ M-COPSv	SvO_2 simulator	890121
Tonometry Module, E-TONO/ M-TONO	Calibration gas and regulator	755580/755534
	Sampling line	733251
	Luer plug	
	Pressure manometer	
	Tonometrics™ catheter	
EEG Module, E-EEG/ M-EEG	Earphones	
	EEG simulator	90502

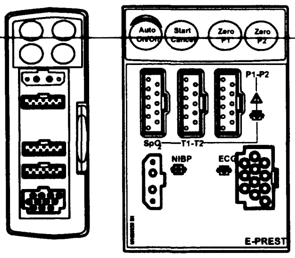
For product(s)	**Tool**	**Order No.**
BIS Module, E-BIS/ M-BIS	BIS simulator or BIS Sensor simulator	900509 900508
E-ENTROPY/ M-ENTROPY	Simulator for M-ENTROPY	N-ES
	Entropy sensor cable	
E-NMT/ M-NMT	NMT simulator	871251
	NMT ElectroSensor	888416
	NMT sensor cable	888415
E-MEM/ M-MEM	MemCard - Menu	
	MemCard - Data	
All M-Modules	Screwdrivers	
All E-Modules	Torx screwdrivers; T8, T10	

NOTE: * Ensure that the calibration gas and regulator are functioning properly before calibration. Perform annual maintenance on the regulator as required. For more information see section *"Adjustments and calibrations"* in Compact Airway modules slot.

1.2.1 Hemodynamic patient simulators

The following tables present the patient simulators' compatibility with each hemodynamic module, and the accessories needed:

Table 1 Patient simulators' compatibility with each hemodynamic module

Module	**Parameter**	**Patient simulator**		
		M1010831	**MedSim**	**874027**
E-PSM(P), E-PRESTN 	ECG	Ok	Multilink ECG acc.	Not compatible
	T	402015-004	402015-004 and M1010832	
	InvBP	Ok	M1010858	

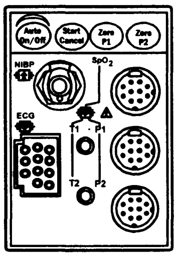
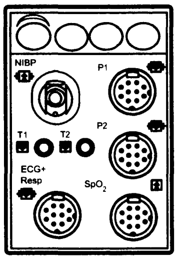
Module	**Parameter**	**Patient simulator**		
		M1010831	**MedSim**	**874027**
M-PRESTN  Auto On/Off Start Cancel Zero P1 Zero P2 NIBP SpO2 ECG T1 P1 T2 P2	ECG	Ok	Multilink ECG acc.	Not compatible
	T	Ok	M1010832	M1010832
	InvBP	Not compatible	Ok	Ok
M-NESTPR 	ECG	Not compatible	300 series acc.	Ok
	12 lead ECG	Not compatible	300 series acc.	Not compatible
	T	Ok	M1010832	M1010832
	InvBP	Not compatible	Ok	Ok

Table 2 Adapter cables for hemodynamic patient simulators

Patient simulator	**Adapter cables for simulators**	
Hemodynamic patient simulator	Dual temperature adapter cable	402015-004
Hemodynamic patient simulator	Dual Inv.BP adapter cable	2005772-001
Medsim	Temperature adapter cable	M1010832
Medsim	Inv.BP adapter cable	M1010858
Lionheart & MPS450	Temperature adapter cable	M1010846
Lionheart & MPS450	Inv.BP adapter cable	M1010862

1.3 Recommended parts

For product(s)	**Part**	**Order No.**
5-Module Frame, F-CU5(P)	Fan filter	M1016473
Central Processor Unit, F-CPU	Fan filter	M1014462
8-Module Frame, F-CU8	Fan filter	871558
Extension Frame, F-EXT4	Fan filter	874594
CPU Board, B-CPU5/B-CPU4, every 8 years	Battery for SRAM/Timekeeper	197230

Central Processor Unit, F-CPU, every 4 years	Lead acid battery, 6V, 1.2Ah	17006
8-Module Frame, F-CU8, every 4 years		
E-REC/ M-REC	Recorder paper	74205
Tonometry Module, E-TONO/ M-TONO	Special tube (Nafion™)	733382

1.4 Planned maintenance parts

1.4.1 PM parts for Compact Airway Modules, E-CXXXXX/ M-CXXXXX without CO2 absorber - Anesthesia

Part	**Order No.**	**For product(s)**
Special tube (Nafion)	733382	All Airway modules
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	653125	All Airway modules
D-fend (black)	876445	All Airway modules
Sampling line 2.0 m	73318	Compact Airway Modules
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001758.

1.4.2 PM parts for Compact Airway Modules, E-CXXXXX/ M-CXXXXX with CO2 absorber - Anesthesia

Part	**Order No.**	**For product(s)**
~~Special tube (Nafion 2 pcs)~~	~~733382~~	~~All Airway modules~~
Ref. gas sticker	893110	Compact Airway Modules
Filter (2 pcs)	886136	Compact Airway Modules
Filter assembly	896025	Compact Airway Modules
Fan filter	886236	Compact Airway Modules
D-fend O-ring (2 pcs)	653125	All Airway modules
D-fend (black)	876445	All Airway modules
Sampling line 2.0 m	73318	Compact Airway Modules
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001760.

1.4.3 PM parts for Airway Module, E-miniC/ M-miniC

Part	Order No.	For product(s)
Special tube (Nafion 2 pcs)	733382	All Airway modules
Mini D-fend O-ring (2 pcs)	656565	E-miniC/ M-miniC
Mini D-fend	8002174 (pkg of 10 pcs)	E-miniC/ M-miniC
Zero valve air filter	M1011471	E-miniC, every 3 years
Zero valve air filter	571421	M-miniC
CO2 Sampling line 3.0 m	733163	E-miniC/ M-miniC
PM sticker	893108	All Airway modules

1.4.4 PM parts for Airway Modules, G-XXXXX

Part	Order No.	For product(s)
Special tube (Nafion)	733383	Airway Modules, G-XXXXX
Special tube (Nafion)	733382	All Airway modules
OM ref. filter	86901	Airway Modules, G-XXXXX
Fan filter	871558	Airway Modules, G-XXXXX
Cable tie	64001	Airway Modules, G-XXXXX
D-fend O-rings (2 pcs)	653125	All Airway modules
D-fend (black)	876445	All Airway modules
Sampling line (3.0 m)	73319	All Airway modules
PM sticker	893108	All Airway modules

NOTE: Corresponding PM kit is available with Order No. 8001762.

For details on recommended accessories see the “Supplies and Accessories” catalog.

2 Planned maintenance check list

2.1 Visual inspection/preparation

2.1.1 General

NOTE: Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.

Make sure that the monitor is switched to standby.

Disconnect the mains power cord. If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable from UPI4NET board, B-UPI4NET or the Network Board, B-NET. If the Memory Module, E-MEM/ M-MEM is connected, remove any memory cards.

1. Check all the units visually. Check that all parts are intact and that the cables and screws are connected and tightened properly.

   Especially check the following parts:

   - Video displays: the display power cord is locked to the display.
   - F-CU5(P), F-CPU and N-AC: all the screws and the equipotential tap on the N-AC are tightened properly.
   - F-CU8: the equipotential tap and all the screws are tightened properly.
   - Airway Module, G-XXXXX: the equipotential tap is tightened properly.

   Check that modules go in smoothly and lock up properly in all module slots.
2. Replace the batteries, if necessary.

   The manufacturer recommendations are:

   - Replace the lead-acid battery in the module frames' F-CU5(P)/ F-CU8 power supply unit every 4 years.
   - Replace the SRAM/Timekeeper battery on the CPU board every 8 years.

   NOTE: The Factory Reset must be performed if the SRAM/Timekeeper battery, or the SRAM/Timekeeper chip is replaced.
3. Clean or replace the fan filters in the 5-Module Frame, F-CU5(P) and Central Processor Unit, F-CPU or in the 8-Module Frame, F-CU8.
4. F-CU8: Check that the fuses are of the correct rating.

2.1.2 Extension Frame, F-EXT4

1. If the F-EXT4 contains a fan, clean or replace the fan filter.

2.1.3 Airway Module, G-XXXXX

1. Remove the Airway Module case, the top protection cover and the bronze plate from the side of the O2 sensor, if installed.

Detach the PVX board with the support plate, if installed, and leave the board detached until further notice.

Check that all cables and tubes are connected properly and that there are no loose objects inside the module.

NOTE: Make sure that none of the tubes are in contact with the sampling pump or with the O2 sensor.

2. Install the PM kit, "PM parts for Airway Modules, G-XXXXX":
   - Replace the special tubes (Nafion™).
   - Replace or install the OM ref. filter.
   - Check the D-fend O-rings (2 pcs) and replace them, if necessary
   - Replace the D-fend (black) and the Sampling line (3.0 m)
   - Clean or replace the Fan filter.

   NOTE: Use only approved sampling lines to ensure proper functioning.
3. Manufacturer recommendation is to replace the CO_2 absorber every 4 years. Replace the absorber, if necessary.

Connect the Airway Module to one of the module slots in the F-CU8 module frame with a long gas interface cable (the grounding plates of the cable should be removed for the procedure).

2.1.4 Compact Airway Module, E-CXXXXX/ M-CXXXXX

1. Detach the module box.

   Check that all cables and tubes are connected properly and that there are no loose objects inside the module.

   NOTE: The tubes connected to the Oxygen board pressure transducers should not be pressed too deep.

   NOTE: Make sure that the tubes are not in contact with the sampling pump or the O_2 sensor, or its springs.
2. Install the PM Kit:
   - Replace the special tubes (Nafion™).
   - Replace the Ref. filter assembly.
   - Replace the filters in the pneumatic unit (1 or 2 pcs).
   - Check the D-fend O-rings and replace them, if necessary.
   - Replace the D-fend and sampling line.
   - Clean or replace the fan filter.

   NOTE: Use only approved sampling lines to ensure proper functioning.
   Use a 2 m/7 ft. sampling line with Compact Airway Modules M-COVX and M-CAiOVX.
3. Manufacturer recommendation is to replace the CO_2 absorber every 4 years. Replace the absorber if necessary.

   Note: All Compact Airway Modules do not contain a CO_2 absorber.

Connect the Compact Airway Module to one of the module slots in the module frame with a long gas interface cable (the grounding plates of the cable should be removed for the procedure).

2.1.5 Single-width Airway Module, E-miniC/ M-miniC

1. Detach the module box.
2. Check that all cables and tubes are connected properly and that there are no loose objects inside the module.
3. Install the PM Kit:
   - Replace the special tube (Nafion™).
   - Replace the Zero valve air filter every three years.
   - Check the D-fend body connector O-rings and replace them, if necessary.
   - Replace the Mini D-fend and the sampling line.

   NOTE: Use only approved sampling lines to ensure proper functioning.
4. Connect the module to a module slot with a long gas interface cable (the grounding plates of the cable should be removed for the procedure).

✍

2.1.6 Tonometry Module, E-TONO/ M-TONO

1. Detach the module box.

   Check that all cables and tubes are connected properly and that there are no loose objects inside the module.
2. Replace the Special tube (Nafion™).

   Reattach the module box and check that the latch moves properly. Plug the module back into the module frame.

✍

2.1.7 Recorder module

1. Clean the recorder.
   - Open the paper compartment hatch and remove the paper roll, if installed.
   - Remove any paper chaff from the paper compartment.
   - Clean the thermal printhead and the small glass window in front of the static brush with a cotton swab dipped in isopropyl alcohol, if necessary.

   NOTE: Avoid contact with the rubber paper roller. Be careful to limit the application of alcohol to the thermal printhead and the window.
   - Reinstall the paper roll.

✍

2.1.8 Modules with NIBP measurement

1. Check the NIBP pump filter. Replace the filter, if necessary.

Note: M-NIBP Rev. 00-03 does not contain a NIBP pump filter.

Plug the module back into the frame.

2.2 Functional inspection

2.2.1 General

1. F-CU5(P): Connect all the parts together. Check that the cables and screws are tightened properly. Connect the mains power cord to the N-AC Power Unit.
   F-CU8: Connect the mains power cord to the F-CU8.
   Check that the stand-by LED is lit.
2. Switch the monitor on.

   Check that the monitor starts up properly, i.e. the alarm LEDs turn on and off, normal start-up sound is heard from the loudspeaker and the monitoring screen appears.

   No error messages should appear on the screen.
3. Configure the screen for the parameters that are connected.
   Check that all the connected modules are recognized, i.e. the required parameter information is shown on the screen.

   If connected, the recorder should record two lines of start-up information.

   Preset measurement settings for those parameters that are connected are, for example:

Others - ***EEG - Montage - EEG Channels - 4***
- Montage type - Bip
Others - ***EEG - EEG Setup - Numeric 1 - MF***
- Numeric 2 - Ampl.

Others - ***EP - Cycle - Cont.***
- AEP Setup - AEP Channels - 2
- Responses -100
- Stim. Frequency - 1.1Hz
- Stim. Intensity - 90 dB
- Sweep length - 100 ms
- EP size - 1

or

Others – ***BIS – Scale - 100uV***
– Smoothing Rate 30s
– BIS Setup –Automatic Check –ON

Recorder - ***Record Waveforms - Waveform 1 - ECG1***
- Waveform 2 - P1
- Waveform 3 - P2

Invasive Pressures - ***P1 'ART' Setup - Label - ART***
- P2 'CVP' Setup - Label - CVP
- P3 Setup - Label - PA

- P4 Setup - Label - P4
- P5 Setup - Label - P5
- P6 Setup - Label - P6

Pulse Oximetry - ***Pleth Scale - AUTO***
or
Others - ***SPO2 Setup - Pleth Scale - AUTO***

Airway Gas - ***Spirometry View - Scaling - Indep.***
- Paw Scale - 20
- Flow Scale - 15

or

Ventil. - ***Spirometry Setup - Scaling - Indep.***
- Paw Scale - 20
- Flow Scale - 15

Others - ***C.O. View - C.O. Setup - Scale - 1.0 °C***
- Injectate Volume - 10 ml
- Measurement Mode - SET

Others - ***SvO2 - Update HGB - 115 g/l***

or

Wedge C.O: SVO2 - ***C.O. View - C.O. Setup - Scale - 1.0 °C***
- Injectate Volume - 10 ml
- Measurement Mode - SET

Wedge C.O: SVO2 - ***SvO2 - Update HGB - 115 g/l***

Others - ***NMT - Stimulus Mode - TOF***
- Set Cycle Time - 10 sec.

Others - ***NMT -NMT Setup - Current - s(70mA)***
- Pulse Width - 200 ms
- Stim. Beep Volume - 2

Others - ***Resp Setup - Size - 1.0***
- Resp Rate Source - AUTO
- Measurement - ON
- Detection Limit - AUTO

2.2.2 Display

1. Check that the picture on the screen is adjusted correctly. Readjust the picture with the adjustment knobs or with the display menu keys, if necessary.

✍

2.2.3 Keyboard(s)

1. Tests with the Command Bar / Command Board:

- Press the **Help** key. Turn the ComWheel in both directions and check that the cursor in the menu moves correspondingly. Select ***Normal Screen*** and check that the menu disappears from the screen.
  Check the rest of the menu keys by pressing them one by one.

Tests with the ARK Keyboard:

- Enter the ***Keyboard*** service menu
- Check functioning of the ComWheel.
- Press all keys, except **Modify** and **Print**. Check that each key produces a sound from the loudspeaker, or the 'Message count' value in the service menu increases.
- Press the **Modify** and **Print** keys and check that the corresponding menus appear on the monitor screen.

Tests with the Remote Controller:

- Enter the ***Keyboard*** service menu.
- Check functioning of the ComWheel.
- Press all keys. Check that each key produces a sound from the loudspeaker, or the 'Message count' value in the service menu increases.

2.2.4 5-Module Frame, F-CU5(P)/ 8-Module Frame, F-CU8

1. Check that all the fans are running.
2. Check that the clock on the screen shows correct time.
   Readjust the time and date, if necessary.
3. Enter the ***Service Log*** service menu.
   Check the content of the Service Log for possible problems.

✍

2.2.5 Extension Frame, F-EXT4

1. If the F-EXT4 contains a fan, check that the fan is running.
2. Check that the modules in the F-EXT4 are recognized, i.e. the required parameter information is shown on the monitor screen.
   Disconnect the Extension Module, M-EXT shortly, then reconnect the module back into the F-CU8.
   Check that the modules in the F-EXT4 are still recognized.

✍

2.2.6 Airway Module, G-XXXX

1. Check that the Airway Module fan is running.
2. Wait until the message 'Calibrating gas sensor' disappears from the screen, then enter the ***ACX*** service menu.
   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.

3. If the module contains a membrane key on the front panel, press the key for at least one second and check that it is identified.
4. Check that the 'Calib zero' value for N2O is less than 61000.
5. Check that the 'Ambient' value corresponds with the current ambient pressure (±20 mmHg).
6. Check the CO_2 absorber.

   Keep the tip of the sampling line away from you and let the monitor draw in room air. Check that the 'Insp CO_2' value on the ***ACX*** service menu is higher than 3.
7. Perform a sampling system leak test.
8. Block the tip of the sampling line with your finger until the 'Amb-Work' value becomes stable. Check that the value reaches 110.
9. Check the flow rates and adjust them, if necessary.

   NOTE: If any of the constriction cassettes is replaced, the leak test should be repeated.
10. Perform a gas calibration:

    NOTE: For maximum accuracy, a warm-up time of 30 minutes is recommended.

    NOTE: If the module contains the agent identification unit, ASX-100 or ASX-200, keep feeding gas for at least 15 seconds after the message 'Adjust' appears on the menu. This gives the agent identification unit enough time for calibration.
11. Switch the monitor to standby.

    Reinstall the earlier detached PVX board and reassemble the module.

    Connect the Airway Module to the F-CU8 with the original gas interface cable.

    Switch the monitor back on and wait until the message 'Calibrating gas sensor' disappears from the screen.

Agent identification

for Airway Modules containing the option

12. Enter the ***ASX*** service menu:

    Feed calibration gas. When a proper absorption spectrum is shown in the menu check that the module identifies the gas and the 'Peak normal' value is close to 10.50 (±0.20). Check also that the difference between the displayed 'Peak normal' and 'Peak mirror' values is not greater than 0.30.

    NOTE: The ASX-100 is not capable of identifying all calibration gases. The ***ASX*** service menu values are not updated with the ASX-100.

Patient Spirometry

for Airway Modules containing the option

13. Connect a clean spirometry tube and D-lite to the module.

    Perform the spirometry tubing leak test.

14. Connect the sampling line to the D-lite. Breathe through the wider side of the D-lite. Check that the flow waveform moves downwards when you breathe in, and upwards when you breathe out.

✍

General for all Airway Modules [General]

15. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
16. Remove the D-fend and check that the message 'Check D-fend' appears on the screen within 30 seconds.

✍

2.2.7 Compact Airway Module, E-CXXXXX/ M-CXXXXX

1. Check that the fan is running.
2. If the module contains membrane keys on the front panel, press each of the keys for at least one second and check that their are identified.

   NOTE: The Compact Airway Module membrane keys require S/5 main software.
3. Wait until the message 'Calibrating gas sensor' disappears from the screen, then enter the Compact Airway Module ***General*** service menu.

   Check that the module configuration displayed corresponds with the Compact Airway Module type being used.
4. Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.
5. Enter the ***Gases*** service menu: Check that the 'Ambient' value displayed corresponds with the current ambient pressure (±20 mmHg).
6. Check that the flow measurement offset, i.e. the sample 'Zero' value displayed is within ±10 ml/min.
7. Perform a sampling system leak test.
8. Check the flow rates. Adjust the sampling flow, if necessary.
9. Perform a gas calibration:

   NOTE: For maximum accuracy, a warm-up time of 30 minutes is recommended.

   NOTE: For correct measurement values, modules need different amounts of oxygen in the calibration. If you do not use the recommended calibration gases, the calibration does not succeed.

✍

Anesthesia Agent

Compact Airway Modules w/ the option

10. Enter the ***Gases*** service menu.

    Feed calibration gas (order code 755583) continuously for at least 30 seconds and check that the 'ID' in the service menu shows 'DES' and that the value for 'ID unrel.' is lower than 50.

Patient Spirometry

Compact Airway Modules w/ the option

11. Enter the ***Spirometry*** service menu.

    Connect a clean spirometry tube and D-lite to the module.

    Perform the spirometry leak test.
12. Connect the sampling line. Breathe through the wider side of the D-lite. Check that the flow waveform moves downwards when you breathe in, and upwards when you breathe out.

General

For all Compact Airway Modules

- Switch the monitor to standby and reassemble the module.

  NOTE: Attach the plastic cover to the CPU Board before fitting the module box. Make sure that the grounding claws in the front panel frame make good contact with the module box.

  NOTE: When reassembling the module make sure that the tubes are not pinched between the module box and internal parts.

  Insert the Compact Airway Module into the frame. Switch the monitor back on and wait until the message 'Calibrating gas sensor' disappears from the screen.

13. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.
14. Detach the D-fend and check that the message 'Check D-fend' appears on the monitor screen within 60 seconds.

2.2.8 Single-width Airway Module, E-miniC/ M-miniC

1. Wait until the message 'Calibrating gas sensor' disappears from the screen, then enter the Gas Unit ***General*** service menu.

   NOTE: The Airway Module M-miniC requires S/5 main software L-ANE02(A) / L-ICU02(A) or later.
2. Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.
3. Enter the ***Gases*** service menu: Check that the 'Ambient' value displayed corresponds with the current ambient pressure (±20 mmHg).

4. Check that the flow measurement offset, i.e. the sample 'Zero' value displayed is within ±10 ml/min.
5. Perform a sampling system leak test.
6. Check the flow rates. Adjust the sampling flow, if necessary.
7. Block the tip of the sampling line with your finger and check that the message 'Sample line blocked' appears on the monitor screen within 30 seconds.

   Remove the Mini D-fend and check that the message 'Check D-fend' appears on the screen within 30 seconds.
8. Perform a gas calibration:

   NOTE: For maximum accuracy, a warm-up time of 30 minutes is recommended.

2.2.9 Tonometry Module, E-TONO/ M-TONO

1. Enter the ***TONO*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second.

   Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

   Check that the 'general error status', 'module pneumatics error status', 'module hardware error status' and 'testbit status' are all zero.
2. Check the function of the front panel **Start-Stop** and **Lab Data** membrane keys.
3. Perform the pressure sensor calibration.
4. Perform the system test.
5. Perform the gas calibration.
6. Connect the catheter to the module. Start measurement by pressing the **Start-Stop** key on the module. Check that the catheter fills up.

   Stop the measurement by pressing the **Start-Stop** key. Check that Meas. Off text appears in the digit field.

2.2.10 Hemodynamic Modules

ECG and RESP measurements

1. Enter the ***ESTP: ECG*** service menu.

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the ECG/RESP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.
2. Check the front panel membrane key **ECG LEAD,** if available.
3. Check that the 'Power Freq' value is set according to the mains power frequency. Correct the setting, if necessary.
4. Connect a 3-lead ECG trunk cable without a lead set to the module. Check that the message 'Leads off' is displayed on the screen.

Connect a 12-lead ECG trunk cable without a lead set to the module. Check that the message 'Leads off' is displayed on the screen.

5. Modules without the 12-lead capability (M-ESTPR, M-ETPR, M-ESTR, M-NESTPR, M-NETPR and M-NESTR modules): connect a 5-lead ECG cable to the module. Connect the cable leads to a patient simulator.

   Check that the 'Cable type' shows 5 lead.

6. Disconnect one of the leads and check that the corresponding electrode in the service menu shows OFF within 10 seconds from the disconnection, then reconnect the lead.

   Check the rest of the leads using the same method.

   NOTE: With NESTPR/ESTPR type modules: when the ground lead(black) is disconnected, all the electrodes should show OFF. With M-NE12STPR, M-PRESTN, E-PRESTN and E-PSM: when any of the limb leads is disconnected, the measurement will automatically change to 3 electrode ECG measurement.

   NOTE: The asystole and different leads off messages are shown using certain priority, Even though one of the leads is disconnected, the related leads off message may not appear on the screen.

   NOTE: When RA, LA, LL or RL electrode is disconnected, all V electrodes show OFF.

   NOTE: With NESTPR/ESTPR type modules and 5 lead cable, the state of V2, V3, V4, V5 and V6 electrodes follow the state of the V electrode.

7. Check that all ECG and impedance respiration information is shown on the monitor screen as configured on the simulator.

   Check that the pacer count value in the service menu is shown according to the simulator configuration.

   Change baseline impedance on the simulator and check that appropriate RESP waveform and RR values are shown again within 30 seconds.

   Turn the simulator off. Check that the 'Asystole' and 'Apnea' messages are displayed.

Temperature measurement

8. Enter the ***ESTP: STP*** service menu.

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the STP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

9. Check the temperature measurement calibration using temperature test plugs.

   NOTE: Make sure that the protection for temperature calibration is set on, if calibration is needed.

Invasive blood pressure measurement

10. Check the function of the module front panel membrane keys.
11. Check the InvBP channels with a patient simulator.

Zero the InvBP channels, then check that the values and waveforms correspond to the simulator settings.

✍

Sp02 measurement

12. Check that the message 'No probe' is shown, when no Sp0$_2$ sensor is connected.

    Connect Sp0$_2$ finger probe to the module. Check that the message 'Probe off' is shown, when the probe is not connected to a finger.
13. Attach the Sp0$_2$ probe to your finger. Check that a reading of 95-99 and a pleth waveform appear on the screen.

✍

Non invasive blood pressure measurement

14. Enter the ***NIBP*** module service menu.
    Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the NIBP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show ***OK***.
15. Check the function of the front panel membrane keys.
16. Check the NIBP tubing system for leakages by performing ***Calibrations - Active leak test.***
17. Perform NIBP calibration by selecting ***Calibration.***
18. Enter the ***Pneumatics*** service menu.
    Check the NIBP watchdog timer activation pressure with a pressure manometer.
19. For Modules M-ESTPR and M-NE(12)STPR: Check the NIBP watchdog timer by performing ***Watchdog -Test Adult*** and ***Test Infant***.
20. Check the safety valve by performing ***Safety Valve - Adult*** and ***Infant.***
21. Attach an adult NIBP hose and cuff onto your arm and perform one NIBP measurement. Check that the module identifies the cuff, i.e. the text 'Adult' appears in the NIBP digit field for a short time.

    Check that the module gives a reasonable measurement result.

E-PSM(P), E-PRESTN:

22. Attach a NIBP cuff hose without cuff identification and check that the module identifies the hose:
    - The message 'Select inflation limits' appears in the NIBP digit field.
    - When you try to start the measurement, the monitor automatically opens the selections ***NIBP Setup- Inflation Limits***.

✍

2.2.11 EEG Module, E-EEG/ M-EEG and EEG Headbox, N-EEG

1. Enter the ***EEG & EP*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values in the module view are not increasing faster than by 5 per second. Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.

   Check that the HB Mod Time-outs, HB Mod Bad Checksum and Mod HB Bad Checksum values are not increasing faster than by 5 per second. Check that the memory of the headbox has passed the internal memory test, i.e. HB Rom Error in the headbox view states 0.
2. Check the **EP Start/Stop** and **Imp. Check** membrane keys both in the module and the headbox.
3. Connect the EEG simulator to the headbox. Select 10 kΩ as imped. pos. and imped. neg. value on the simulator. Go to ***EEG & EP*** service menu and select ***Check Electr.*** Check in the headbox view that the impedances in all four channels are 10 kΩ ±1 kΩ.
4. Select 2 kΩ as imped. pos. and imped. neg. value on the simulator. Select 10 Hz 200 µV sinewave on the simulator and check that all the four waveforms have the same form. Check that the size of the waveforms is 200 μV_{pp} ±5 V. Check that the MF value is 10 ±0.5 Hz. Check that the amp value is 71 µV ±3 µV.
5. Plug in the earphones to the headbox.

   NOTE: Be careful with loud stimulation from the earphones when starting AEP stimulation.

   Start AEP stimulation by pressing the **EP Start/Stop** button on the module. Check that the clicking sound comes from the earphones in 1.1 Hz frequency. Stop the stimulation by pressing again the **EP Start/Stop** button on the module. Check that the clicking stopped.

2.2.12 BIS Module, E-BIS/ M-BIS

1. Enter the ***BIS*** service menu:

   Check that the DSC is connected to the module and the PIC+ cable is connected to the DSC.

   Check that the Mod Mon Time-outs, Mon Mod Bad checksums, Mod Mon Bad Checksums, Bad Checksums from BIS values in the module view are not increasing faster than by 5 per second. Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.
2. Check the **BIS** and **Sensor Check** membrane keys of the module. Stay in the module view and press each key for at least one second and check that the key being pressed is identified, i.e. the corresponding 'PUSHED' text appears in the service menu.
3. Check that 'Messages from BE' are increasing steadily.

   Go to the ***Sensor*** menu.
   Check that

   - Sensor type indicates 'No Sensor' (i.e.no sensor is identified)
   - no sensor is identified
   - mains frequency is set correctly
   - check that 'BE powerup test', 'DSC selftest Ch1' and 'DSC selftest Ch2' all show 'PASSED'

   (if not, go to ***BIS Setup*** menu, perform DSC Test and check the results again)

4. Connect the BIS simulator to the PIC+ cable. See that 'Checking sensor' text and image appear in the waveform numeric field. Wait for a while and check that all sensors show 'PASS'. Check that the 'Sensor type' shows correct information.
5. Check that the 'BIS', 'SQI' and 'SR' values are between 0...1000, and the 'EMG' value between 0...10000

   NOTE: If Sensor Simulator 900508 is used, the values can be out of the given range.
6. Go to the ***Module*** menu

   Check that no BIS engine errors appear.

   Perform sensor check by pressing **Check Sensor** and see that the check is passed.

   During the sensor check the Impedance meas. should show 'CYCLIC'. During operation the Impedance meas. should show 'COMBINED' or 'OFF' (depending on the user setting in ***BIS Setup*** menu)

   ✍

2.2.13 Entropy Module, E-ENTROPY/ M-ENTROPY

1. Enter the ***Entropy*** service menu.

   Check that the Entropy sensor cable is connected to the module.

   Check that the Time-outs, Bad checksums and Bad c-s by mod values in the module view are not increasing faster than by 5 per second. Check that the memories of the module have passed the internal memory test, i.e. RAM, ROM and EEPROM all state OK.
2. Check the **Entropy** and **Check Sensor** membrane keys of the module. Stay in the module view and press each key for at least one second and check that the key being pressed is identified, i.e. the Check Sensor text is highlighted in the service menu and that pressing the **Entropy** key brings up the ***Entropy*** menu.
3. Connect the Entropy simulator (N-ES) to the cable. See that the 'Checking sensor' text and image appear in the waveform numeric field. Wait for a while and check that all sensors show "PASS".
4. Check that the EntrEEG waveform and RE and SE values appear on the monitor screen.

   ✍

2.2.14 Pressure/Pressure Temp Modules, E-P, E-PT, M-P, M-PT

1. Enter the ***P/P*** module service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the PT board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

   ✍

Invasive blood pressure measurement

2. Check the function of the front panel **Zero P3** membrane key.
3. Check the InvBP channel with a patient simulator.

Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

✍

Modules w/ temperature measurement

4. Check the temperature measurement calibration using temperature test plugs.

   NOTE: Make sure that the protection for temperature calibration is set on

   ✍

2.2.15 Dual pressure Module, E-PP/ M-PP

1. Enter the ***PP*** module service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the Dual Pressure module, M-PP, memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.
2. Check the function of the front panel **Zero P5** and **Zero P6** membrane keys.
3. Check the InvBP channels with a patient simulator.

   Zero the InvBP channels. Then check that the values and waveforms correspond to the simulator settings.

   ✍

2.2.16 Cardiac Output Modules, E-COP, E-COPSv, M-COP, M-COPSv

1. Enter the ***COP*** module service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the module's memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

   ✍

Invasive blood pressure measurement

2. Check the function of the front panel membrane **Zero P4** key.
3. Check the InvBP channel with a patient simulator.

   Zero the InvBP channel. Then check that the values and waveforms correspond to the simulator settings.

   ✍

SvO_2 measurement

4. Check that the SvO_2 values Meas. state, OM fail and OM temp. in the ***COP*** module service menu all show NO OM.
5. Checks with the SvO_2 simulator:

Turn the SvO_2 simulator pulsation switch to Medium and the range switch to Normal pulse. Connect the simulator to the module and check that the following messages appear in the digit field for SvO_2:

Initializing, please wait > Warming up > Not calibrated

Check that 'Meas. state' has changed to ***NORMAL*** and 'OM fail' and 'OM temp.' show OK.

NOTE: The 'OM temp.' may show ***UNSTABLE*** at first, but the message should change to OK within a half a minute.

6. Perform an In Vitro calibration with the SvO_2 simulator.

   Check that the calibration date for In Vitro calibration was updated correctly and the SvO_2 reading on the screen is 81% (±2%).

Cardiac Output measurement

7. Enter the ***COP*** module service menu.

   Check the front panel **Start C.O.** membrane key.

8. Enter the ***C.O. View*** menu:

   Others - ***C.O. View***

   Connect a catheter connecting cable to the module connector C.O.

   If the module contains a C.O. Test connector (M-COP), attach the catheter connector of the connecting cable to the C.O. Test connector. Check that the message 'Cable OK' appears in the menu after the self-test.

   No Catheter > Self Test in Progress > Cable OK

9. Check the C.O. measurement with a patient simulator.

2.2.17 NIBP module, M-NIBP

1. Enter the ***NIBP*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the NIBP board memories have passed the internal memory test, i.e. RAM, ROM and EEPROM all show OK.

2. Check the front panel LEDs and membrane keys using the ***Buttons/Leds*** service menu.
3. Check the NIBP tubing system for leakages by performing ***Active leak test.***
4. Perform NIBP calibration by selecting ***Calibration***.
5. Enter the ***Pneumatics*** service menu.

   Check the NIBP watchdog timer activation pressure with a pressure manometer.

6. Check the NIBP watchdog timer by performing ***Watchdog -Test Adult*** and ***Test Infant***.
7. Check the safety valve by performing ***Safety Valve - Adult*** and ***Infant***.
8. Attach an adult NIBP cuff onto your arm and perform one NIBP measurement. Check the module identifies the cuff, i.e. the text 'Adult' appears in the NIBP digit field for a short time.

Check that the module gives a reasonable measurement result.

✍

2.2.18 NeuroMuscular Module, E-NMT/ M-NMT

1. Enter the ***NMT*** module service menu:

   Check that the 'Time-outs', 'Bad checksums' and 'Bad c-s by mod' values are not increasing faster than by 5 per second. Check that the module's memories have passed the internal memory test, i.e. 'RAM', 'ROM' and 'EEPROM' all state OK.
2. Check the function of the front panel membrane keys **Start-Up** and **Stop/Continue**.
3. Check that the message 'Cable off' is shown in the digit field and that 'Cable' on the service menu states ***OFF***.

   Plug the NMT Sensor Cable with the NMT ElectroSensor into the front panel connector NMT. Check that the message in the digit field changes to 'Measurement OFF' and 'Cable' in the service menu states ***EMG*** and ***ELECTR. OFF***.
4. Place a 3 kΩ resistor between the ElectroSensor's stimulus electrode leads (brown and white). Perform ***Start Curr. Test.***

   Check that the test was successful, i.e. the 'Current test (mA):' in the menu states ***30 OK, 50 OK*** and ***70 OK***.

   Connect the M-NMT ElectroSensor leads to the NMT simulator. Set the switch on the simulator to FADE OFF and turn the knob to MAX. Check that 'Cable' in the service menu states now only ***EMG***.
5. Start the NMT measurement (TOF) by pressing the **START-UP** key on the module.

   Check that the found supramaximal current is less than 70 mA, i.e. the 'Current set' value in the service menu is less than 700.
6. Check that the digit field TOF% value is within 95-105, Count is 4 and T1% is within 95-105.
7. Check that the Noise value in the service menu remains under 100.

✍

2.2.19 Nellcor Compatible Saturation module, E-NSAT/ M-NSAT

1. Enter the ***M-SAT*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the NSAT module's ROM memory has passed the internal memory test, i.e. ROM shows OK.

   Check that all three error indicators, Preamp Error, QUART Error and I/O Error state NO.
2. Check that the SpO_2 probe related status information in the menu is correct. Only the 'NoProbe' should be active (1), when no probe is connected.
3. Connect a Nellcor SpO_2 finger probe to the module. Check that the message 'Pulse search' is shown and the corresponding status information in the menu is active. Check that the shown message changes to 'Check probe' within 30 seconds.

4. Attach the SpO$_2$ probe on your finger. Check that a reading of 95-100 and a proper SpO$_2$ waveform appear.

✍

2.2.20 Datex-Ohmeda Oxygen Saturation module, M-OSAT

1. Enter the ***M-SAT*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check also that the module's ROM memory has passed the internal memory test, i.e. the ROM shows ***OK***.
2. Check that the message 'No probe' is displayed on the screen when no probe is connected.
3. Connect a suitable SpO2 finger probe to the module. Check that the message 'Check probe' is displayed on the screen within 30 seconds
4. Attach the SpO$_2$ probe on your finger. Check that a reading of 95-100 and a proper SpO$_2$ waveform appear.

✍

2.2.21 Memory Module, E-MEM/ M-MEM

1. Enter the ***MemCards*** service menu:

   Check that the module is recognized properly, i.e. Present and Active state YES.
2. Check that the memories and the PCMCIA controller have passed the tests. The status for each should be OK.
3. Select ***Communication***.

   Check that the Interface status states Active continuously and the error counter values on the bottom part of the menu are stable.
4. Select ***Status***.

   Insert Menu card and Data card into the slot.

   Wait until the information is fully updated in the service menu, then check that the Card types are correct and the 'File system' states ATA.

   ~~Check that the rest of the information is reliable and no errors have bee detected.~~

✍

2.2.22 Recorder Module, E-REC/ M-REC

1. Open the paper compartment cover. Check that the message 'Recorder: Cover open' appears on the screen, then close the cover.
2. Press the **Start/Stop** sidepanel key and check that the module starts recording the selected waveforms. Press the **Start/Stop** sidepanel key again to stop recording.
3. Check that the quality of the recordings is acceptable.

✍

2.2.23 Network Board, B-NET and UPINET board, B-UPI4NET

1. Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect them to the Network/UPI4NET Board. Check that the monitor connects to the Datex-Ohmeda Network, i.e. the network symbol appears under the clock on the upper right-hand corner of the screen. Also a message regarding the connected Central should appear in the message field on the screen.

   NOTE: If necessary, the monitor's network communication should be reselected according to the used network software in the ***Network*** service menu.

2. Enter the ***Network*** service menu:

   Check that the counters for data errors (CRC, Frame, Transm.) are stable.

   Check that the counters for hardware errors (Intern., Missed, FIFO, Overrun) all show 0.

2.2.24 Interface Board/Module, B-INT/ E-INT/ M-INT

1. Enter the ***Interface*** service menu:

   Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the memories have passed the internal memory test, i.e. RAM and ROM state OK.

2.2.25 Device Interfacing Solution, N-DISxxx

1. Enter the ***DIS Interfacing*** service menu:
   Check that the DIS module 'tout' and 'cse' values do not increase faster than by 5 per second. Check also that the DIS module memories have passed the internal memory test, i.e. Ram, Rom and EEPROM state all OK.

   Perform the same check for all connected DIS modules.

2.2.26 General

1. Storing trend data

   Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby situation with no power cord.

2. Service reset

   Check the Service Reset switch. Switch the monitor to standby and press the Service Reset switch for at least five seconds. Switch the monitor back on and check that the monitor performs a 'Cold Start.', i.e. all trend information is cleared.

3. Watchdog for Display Controller Boards, B-DISP, B-DISP19

   Enter the ***Set/Test*** service menu and perform ***WD by GSP***.

   Check that the monitor restarts.

   ✍

4. Service Log reset

   Enter the ***Service Log*** service menu.

   Clear the content of the Service Log by selecting ***Reset Log*** from the menu.

   ✍

5. Electrical safety check

   Perform an Electrical safety check and a leakage current test.

   Check that the monitor and all connected units function normally after the performed test

   ✍

6. Final cleaning

   Switch the monitor to standby and perform final cleaning.

   Fill in all necessary documents.

   ✍

APPENDIX A Planned maintenance check form, S/5 Anesthesia Monitor and S/5 Critical Care Monitor

Customer	
Service	
Service engineer	Date

Monitor Installation			
F-CU8	D-	K-	G-
S-	L-	E/M-	E/M-
B-	E/M-	E/M-	F-
B-	E/M-	E/M-	N-
B-	B-	E/M-	

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

Visual Inspection		**OK**	**N.A.**	**Fail**
2.1.1. General		☐	☐	☐
2.1.2. Extension Frame, F-EXT4	S/N	☐	☐	☐
2.1.3. Airway Module, G-XXXXX	S/N	☐	☐	☐
2.1.4. Compact Airway Module, E-CXXXXX/ M-CXXXXX	S/N	☐	☐	☐
2.1.5. Single-width Airway Module, E-miniC/ M-miniC	S/N	☐	☐	☐
2.1.6. Tonometry Module, E-TONO/ M-TONO	S/N	☐	☐	☐
2.1.7. Recorder module	S/N	☐	☐	☐
2.1.8. Modules with NIBP measurement		☐	☐	☐
Notes				

Functional Inspection		**OK**	**N.A.**	**Fail**
2.1.1. General		☐	☐	☐
2.2.2. Display		☐	☐	☐
2.2.3. Keyboard(s)		☐	☐	☐
2.2.4. 5-Module Frame, F-CU5(P)/ 8-Module Frame, F-CU8	S/N	☐	☐	☐
2.2.5. Extension Frame, F-EXT4		☐	☐	☐
Notes				
2.2.6. Airway Module, G-XXXX		☐	☐	☐
. Agent identification		☐	☐	☐
. Patient Spirometry		☐	☐	☐
. General		☐	☐	☐
Notes				
2.2.7. Compact Airway Module, E-CXXXXX/ M-CXXXXX		☐	☐	☐
. Anesthesia Agent		☐	☐	☐
. Patient Spirometry		☐	☐	☐
. General		☐	☐	☐
Notes				
2.2.8. Single-width Airway Module, E-miniC/ M-miniC		☐	☐	☐
Notes				
2.2.9. Tonometry Module, E-TONO/ M-TONO		☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
Notes				
2.2.10. Hemodynamic Modules		☐	☐	☐
. ECG and RESP measurements		☐	☐	☐
. Temperature measurement		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. SpO2 measurement		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
Notes				
2.2.11. EEG Module, E-EEG/ M-EEG and EEG Headbox, N-EEG		☐	☐	☐
2.2.12. BIS Module, E-BIS/ M-BIS		☐	☐	☐
2.2.13. Entropy Module, E-ENTROPY/ M-ENTROPY		☐	☐	☐
Notes				
2.2.14. Pressure/Pressure Temp Modules, E-P, E-PT, M-P, M-PT		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. Modules w/ temperature measurement		☐	☐	☐
Notes				
2.2.15. Dual pressure Module, E-PP/ M-PP		☐	☐	☐
Notes				
2.2.16. Cardiac Output Modules, E-COP, E-COPSv, M-COP, M-COPSv		☐	☐	☐
. Invasive blood pressure measurement		☐	☐	☐
. SvO2 measurement		☐	☐	☐

Functional Inspection		**OK**	**N.A.**	**Fail**
. Cardiac Output measurement		☐	☐	☐
Notes				
2.2.17. NIBP module, M-NIBP	S/N	☐	☐	☐
2.2.18. NeuroMuscular Module, E-NMT/ M-NMT	S/N	☐	☐	☐
2.2.19. Nellcor Compatible Saturation module, E-NSAT/ M-NSAT	S/N	☐	☐	☐
2.2.20. Datex-Ohmeda Oxygen Saturation module, M-OSAT	S/N	☐	☐	☐
2.2.21. Memory Module, E-MEM/ M-MEM	S/N	☐	☐	☐
2.2.22. Recorder Module, E-REC/ M-REC	S/N	☐	☐	☐
2.2.23. Network Board, B-NET and UPINET board, B-UPI4NET	S/N	☐	☐	☐
2.2.24. Interface Board/Module, B-INT/ E-INT/ M-INT	S/N	☐	☐	☐
2.2.25. Device Interfacing Solution, N-DISxxx	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
	S/N	☐	☐	☐
Notes				
2.2.26. General		☐	☐	☐
4. Service Log reset		☐	☐	☐
5. Electrical safety check		☐	☐	☐
6. Final cleaning		☐	☐	☐
Notes				

Used spare parts			
Notes			

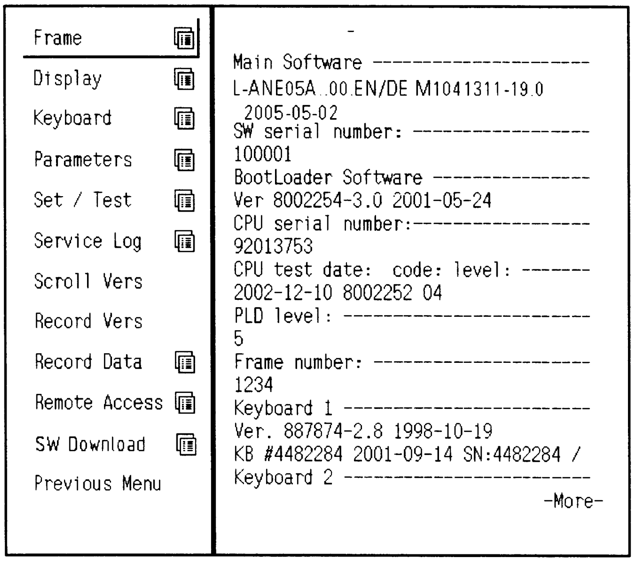
Signature

Datex-Ohmeda

S/5™ Anesthesia Monitor and Critical Care Monitor

Monitor Software L-ANE05(A) and L-ICU05(A)

Service Menu


Frame
Display
Keyboard
Parameters
Set / Test
Service Log
Scroll Vers
Record Vers
Record Data
Remote Access
SW Download
Previous Menu

```
Main Software ----------------------
L-ANE05A..00.EN/DE M1041311-19.0
 2005-05-02
SW serial number: -----------------
100001
BootLoader Software ---------------
Ver 8002254-3.0 2001-05-24
CPU serial number:-----------------
92013753
CPU test date:  code: level: -------
2002-12-10 8002252 04
PLD level: ------------------------
5
Frame number: ---------------------
1234
Keyboard 1 ------------------------
Ver. 887874-2.8 1998-10-19
KB #4482284 2001-09-14 SN:4482284 /
Keyboard 2 ------------------------
                              -More-
```

All specifications are subject to change without notice.

CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

M1027809
June, 2005

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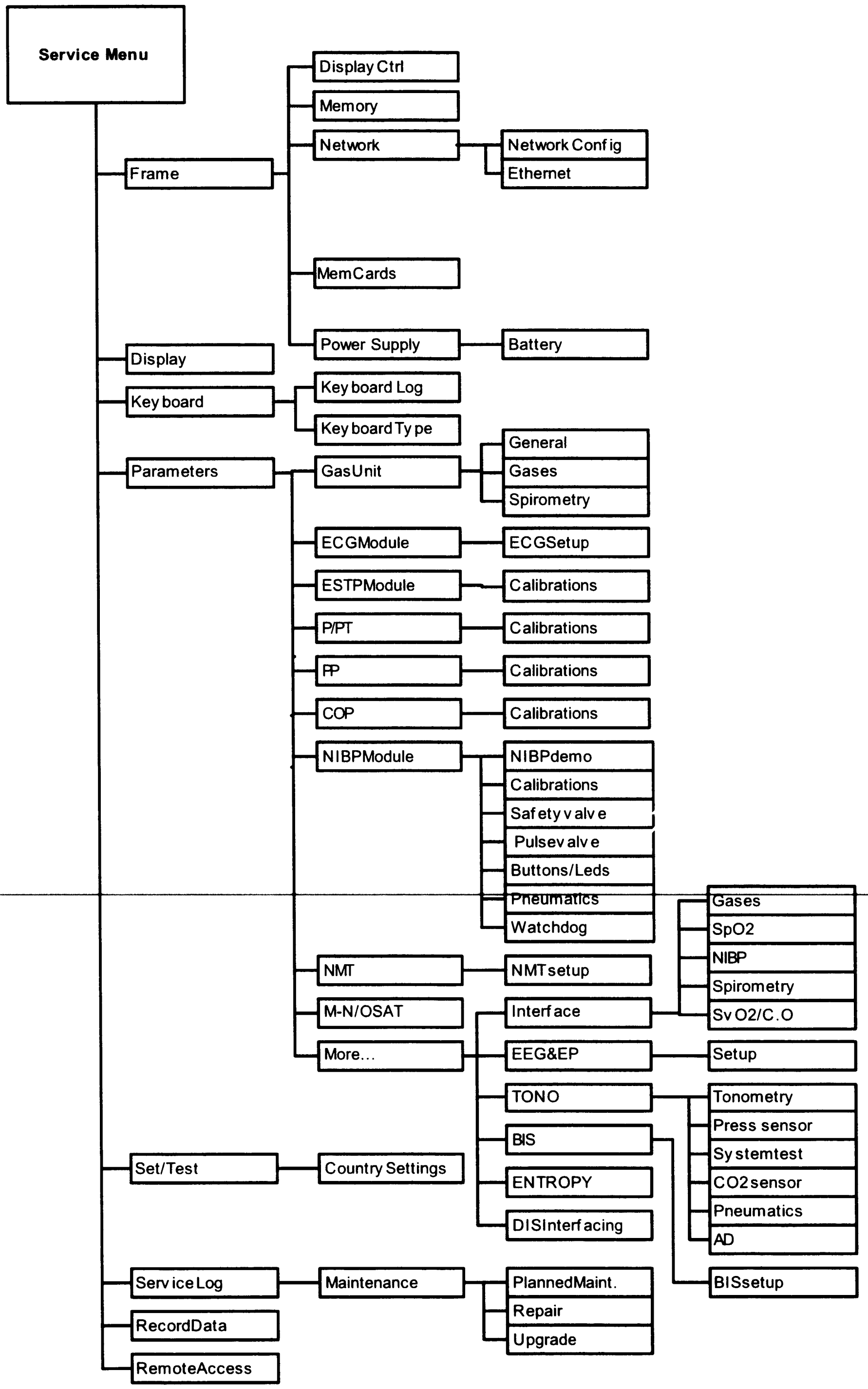
Introduction

The monitor has a **Service Menu**, which is a useful tool to examine monitor functions and to troubleshoot in case a fault occurs.

Service Menu structure

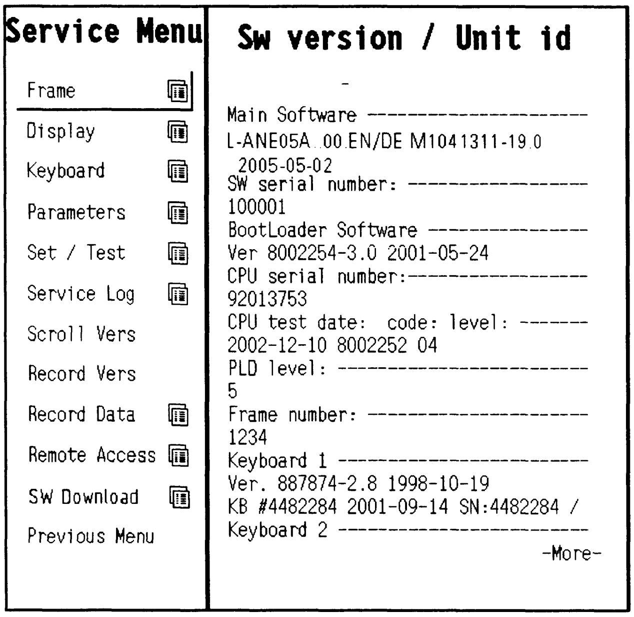

Service Menu
Display Ctrl
Memory
Network
Network Config
Ethernet
Frame
MemCards
Power Supply
Battery
Display
Keyboard Log
Keyboard
Keyboard Type
General
Parameters
GasUnit
Gases
Spirometry
ECGModule
ECGSetup
ESTPModule
Calibrations
P/PT
Calibrations
PP
Calibrations
COP
Calibrations
NIBPModule
NIBPdemo
Calibrations
Safety valve
Pulsevalve
Buttons/Leds
Pneumatics
Watchdog
Gases
SpO2
NIBP
Spirometry
SvO2/C.O
NMT
NMTsetup
M-N/OSAT
Interface
More...
EEG&EP
Setup
TONO
Tonometry
Press sensor
Systemtest
BIS
CO2sensor
Set/Test
Country Settings
ENTROPY
Pneumatics
DISInterfacing
AD
ServiceLog
Maintenance
PlannedMaint.
BISsetup
Repair
RecordData
Upgrade
RemoteAccess

Service Menu

NOTE: The Service Menu pictures and parameter values are for reference only. Details on the menu page can vary depending on the software version and the module type in use.

To enter the service menu:

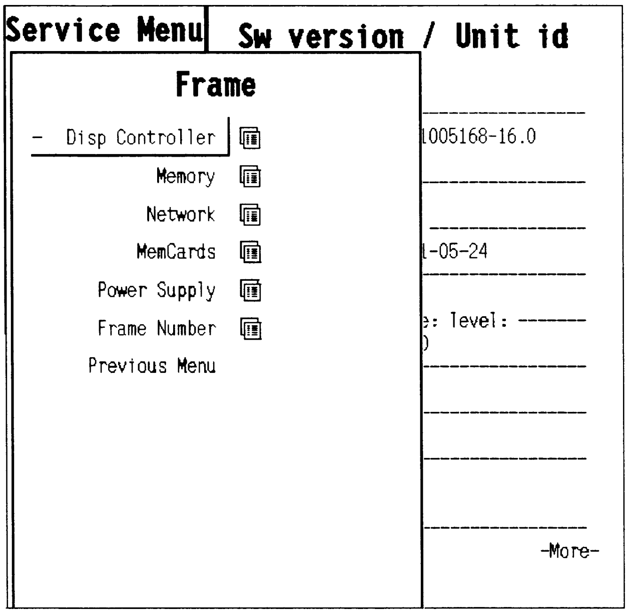
1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** (password 16-4-34).
3. Select ***Service*** (password 26-23-8).


Service Menu
Frame
Display
Keyboard
Parameters
Set / Test
Service Log
Scroll Vers
Record Vers
Record Data
Remote Access
SW Download
Previous Menu
Sw version / Unit id

```
Main Software ---------------------
L-ANE05A..00.EN/DE M1041311-19.0
 2005-05-02
SW serial number: ----------------
100001
BootLoader Software --------------
Ver 8002254-3.0 2001-05-24
CPU serial number:----------------
92013753
CPU test date:  code: level: ------
2002-12-10 8002252 04
PLD level: -----------------------
5
Frame number: --------------------
1234
Keyboard 1 -----------------------
Ver. 887874-2.8 1998-10-19
KB #4482284 2001-09-14 SN:4482284 /
Keyboard 2 -----------------------
                             -More-
```

1 Frame

The frame menu includes service menus common for the frame.


Service Menu
Sw version / Unit id
Frame
- Disp Controller
Memory
Network
MemCards
Power Supply
Frame Number
Previous Menu
1005168-16.0
1-05-24
e: level: -------
-More-

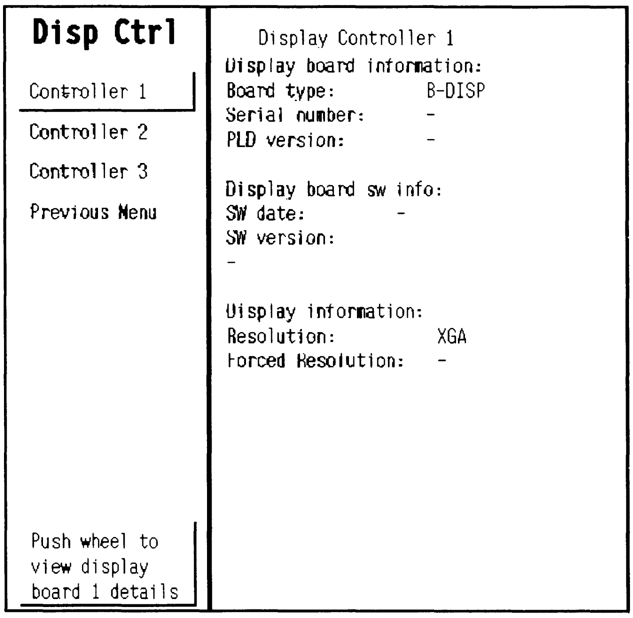
1.1 Display Controller

Controller 1 details of the 1st display controller.

Controller 2 details of the 2nd display controller.

Controller 3 details of the 3rd display controller.

Previous Menu a selection to return to the previous menu.



```
Display Controller 1
Display board information:
Board type:          B-DISP
Serial number:       -
PLD version:         -

Display board sw info:
SW date:         -
SW version:
-

Display information:
Resolution:          XGA
Forced Resolution:   -
```

Details of the display controller boards

NOTE: The values are valid only for B-DISPX and newer display controller boards.

Board type: This is the type of the display controller board in the monitor.

Serial number: Serial number of the display controller board in use.

PLD version: Program version of the programmable logic device.

SW date: Manufacturing date of the display controller software.

SW version: Version of the display controller software.

NOTE: The display controller software is a part of the monitor software, and it is downloaded to the display controller board memory from the CPU board when necessary.

Resolution: This shows the output resolution that is selected through the monitor software menus.

Forced resolution: Forced resolution is the output resolution selected by the display controller board's dip switches or jumpers.

NOTE: The forced resolution settings override the resolution settings selected through monitor menus. The forced resolution (i.e. resolution dip switches) must be set to AUTO to allow the software-selected resolutions to be valid.

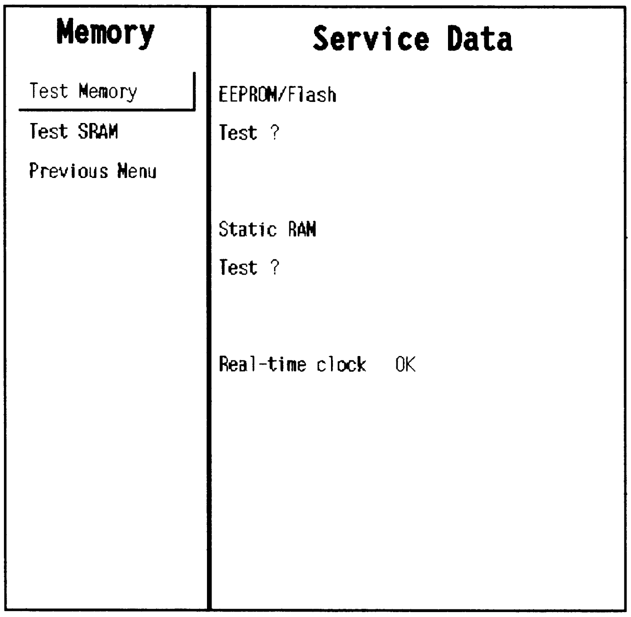
1.2 Memory

A service menu to check the status of the memory used in the CPU board of the monitor.

Test Memory tests the condition of the EEPROM/Flash memory component of the CPU board. If the result of the test is **Fail**, see section "Error messages" in the CPU chapter.

Test SRAM tests the Static RAM memory of the CPU board in a similar way as the EEPROM/Flash memory. If the result of the test is **Fail**, see section "Error messages" in the CPU chapter.

Real-time clock test is run at every start up and also during the operation of the monitor. If the result of the test is **Fail**, the battery for the SRAM timekeeper should be replaced.



Service Data

EEPROM/Flash
Test ?

Static RAM
Test ?

Real-time clock OK

1.3 Network

1.3.1 Network Status

The Network Status view shows the general status of the network.

Location ID: Monitor's location given at the setup.

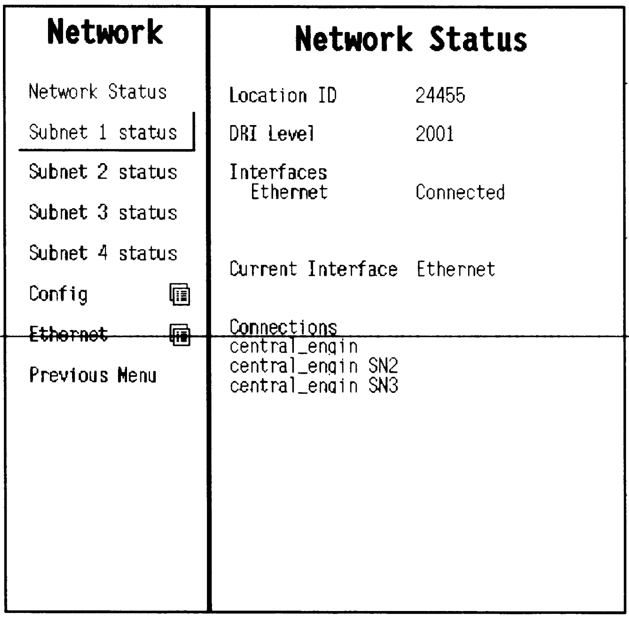
DRI level: Shows the selected level of network communication. The network communication is set according to the network software used (e.g. S-CNET01).

Interfaces: The field indicates if there is a connection to the Datex-Ohmeda network.

Gateway Interface: The field indicates the active network interface (None/Ethernet/WLAN).

Connections: Names of the subnet id:s connected.

The field represents the subnet status menus, i.e. shows the connected subnets. The first three connections are reserved permanently for Datex-Ohmeda Central, and the fourth is reserved for another subnet, e.g. Datex-Ohmeda S/5 Arrhythmia Workstation.



Network Status

Location ID 24455
DRI Level 2001
Interfaces
Ethernet Connected

Current Interface Ethernet

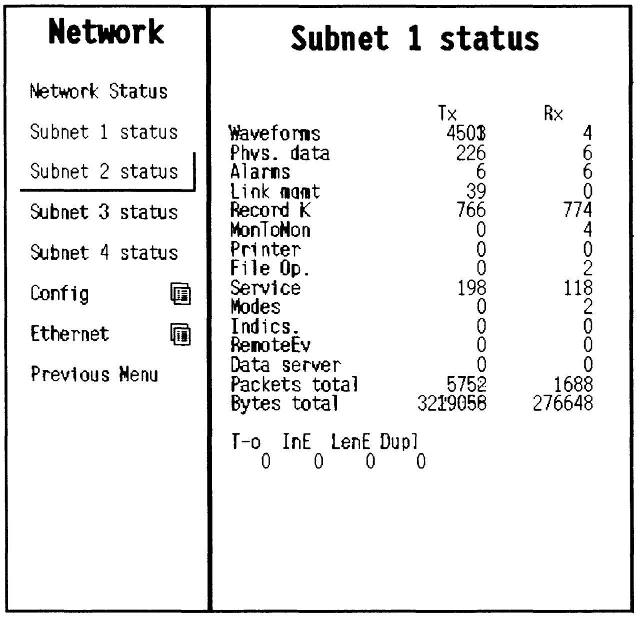
Connections
central_engin
central_engin SN2
central_engin SN3

Subnet Status

The Subnet status view gives more accurate information of the different subnet id:s connected. All four **Subnet status** menus have a similar structure. The number of different packets transmitted and received by the monitor are shown in the columns below Tx and Rx. The packet types are:

Waveforms:	Waveform data
Phys. data:	Physiological numerical data
Alarms:	Alarms, alarm profiles and alarm limits
Link mgmt:	Network management messages
Record K:	Record Keeper data
MonToMon:	Monitor-to-monitor communication related data
Printer:	Printing data and control messages
File Op.:	File operation messages, saving and loading of cases
Service:	Maintenance and service
Modes:	User mode data
Indics.:	Remote indications sent to monitor
RemoteEv:	Remote events
Data server:	Packets of the data server (Arrhythmia Workstation)
Packets total:	Total number of packets sent/received
Bytes total:	Total number of bytes sent/received

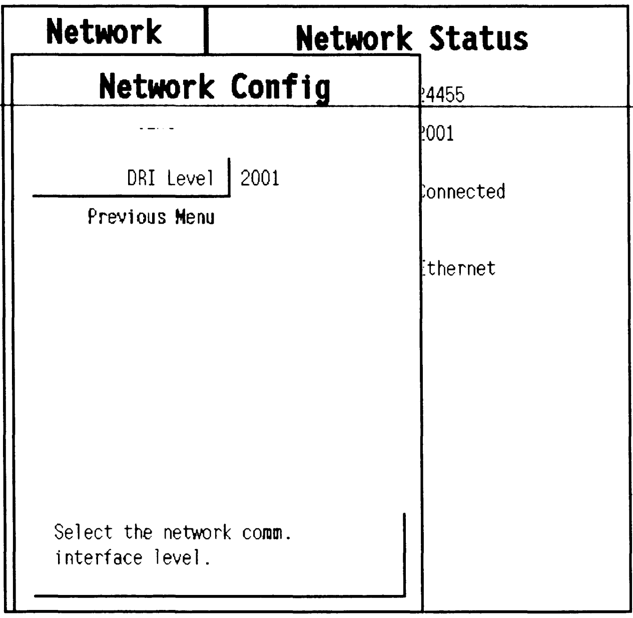
T-o	Number or resendings
InE	Received faulty packets
LenE	Erroneous packet length
Dupl	Same packet received as a duplicate



```
Subnet 1 status

                       Tx        Rx
Waveforms            4503         4
Phys. data            226         6
Alarms                  6         6
Link mgmt              39         0
Record K              766       774
MonToMon                0         4
Printer                 0         0
File Op.                0         2
Service               198       118
Modes                   0         2
Indics.                 0         0
RemoteEv                0         0
Data server             0         0
Packets total        5752      1688
Bytes total       3219058    276648

T-o  InE  LenE Dupl
  0    0    0    0
```

1.3.2 Network Config

The DRI Level is for setting the monitor's network communication. The network communication is set according to the network software used (e.g. S-CNET01).



```
DRI Level  2001

:4455
:001
:onnected
:thernet

Select the network comm.
interface level.
```

1.3.3 Ethernet

The **Ethernet Status** view shows the general status of the ethernet network communication.

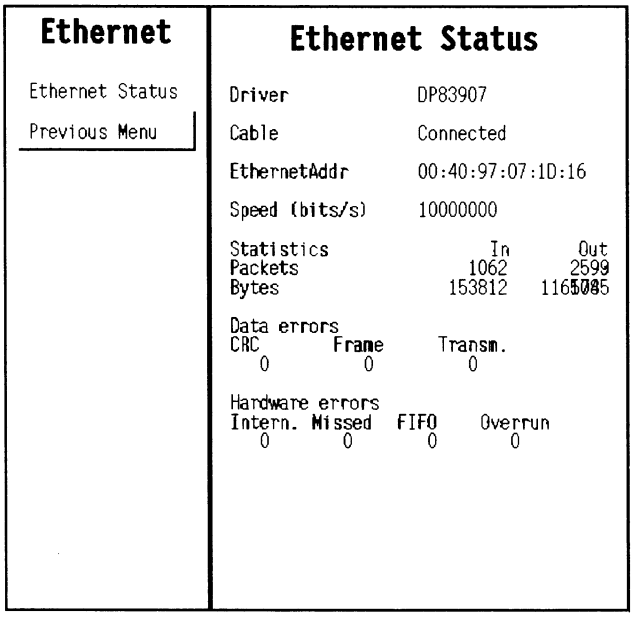
Driver: Ethernet chip name (DP83902, DP83907)

Cable: Indicates if the ethernet cable is connected.

EthernetAddr: Monitor's ethernet address.

Speed: Indicates the current ethernet communication speed.

The service data related to the ethernet status view is described in the following table.



```
Ethernet Status

Driver            DP83907
Cable             Connected
EthernetAddr      00:40:97:07:1D:16
Speed (bits/s)    10000000

Statistics                 In       Out
Packets                  1062      2599
Bytes                  153812   1165085

Data errors
CRC        Frame      Transm.
  0          0          0

Hardware errors
Intern. Missed  FIFO    Overrun
  0        0      0        0
```

Table 1 Ethernet service data

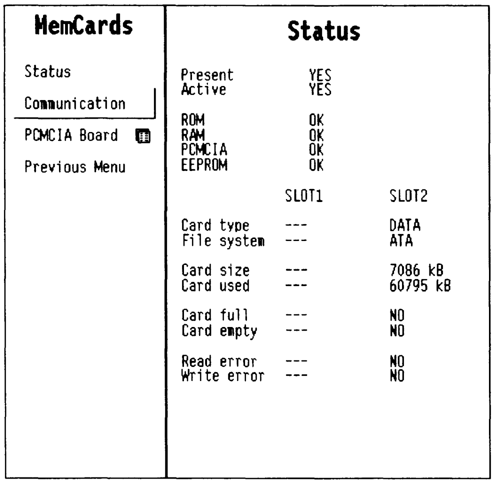
Value	Usage	Notes
Received packets (Statistics In/Packets)	Total number of received packets since last cold start.	
Transmitted packets (Statistics Out/Packets)	Total number of transmitted packets since last cold start.	
Received bytes (Statistics In/Bytes)	Total number of received bytes since last cold start	
Transmitted bytes (Statistics In/Bytes)	Total number of transmitted bytes since last cold start	
CRC errors (CRC)	Number of received packets with incorrect checksum	
Frame errors (Frame)	Number of received packets with incorrect frame structure	Refers to physical layer problems. An erroneous packet often has both frame and CRC error.
Transmission errors (Transm.)	Number or errors in packet Transmission	
Internal errors (Intern.)	Internal error of the network board.	Must always be 0.
Missed packets (Missed)	Number of received packets lost due to overload	Must always be 0
FIFO errors (FIFO)	Internal error of the network board	Must always be 0
Overrun errors (Overrun)	Practically same as above	Must always be 0

1.4 MemCards

1.4.1 Status

Module **Present** indicates whether the module is firmly attached to the monitor. Possible values are YES and NO.
Module **Active** indicates whether the module services are available. Possible values are YES and NO.

ROM indicates the status of the ROM memory of the module. Possible values are OK and ERR.
RAM indicates the status of the RAM memory of the module. Possible values are OK and ERR.
PCMCIA indicates the status of the PCMCIA controller of the module. Possible values are OK and ERR.
EEPROM indicates the status of the EEPROM memory of the module. Possible values are OK and ERR.



```
                    Status

Present        YES
Active         YES

ROM            OK
RAM            OK
PCMCIA         OK
EEPROM         OK

             SLOT1          SLOT2

Card type    ---            DATA
File system  ---            ATA

Card size    ---            7086 kB
Card used    ---            60795 kB

Card full    ---            NO
Card empty   ---            NO

Read error   ---            NO
Write error  ---            NO
```

SLOT1 and **SLOT2** indicate the left hand slot and the right hand slot, respectively.

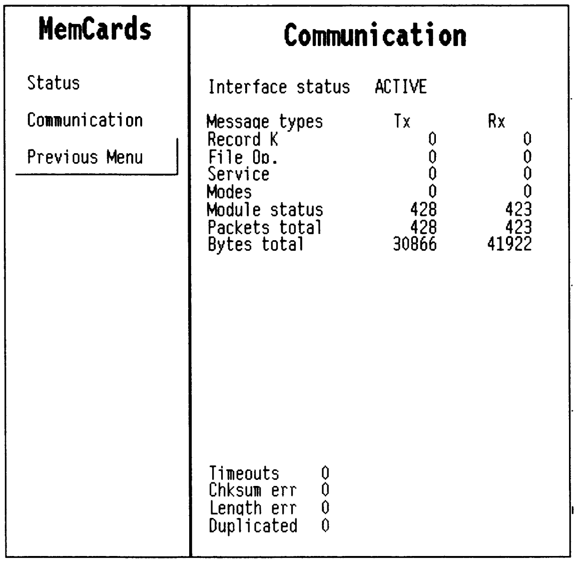
Card type	indicates whether the card is MENU or DATA card. If a duplicated card is inserted, type DUPL.
File system	indicates the type of the memory card in use. The only supported file system is ATA. If a memory card using another file system is used, the message 'UNKNOWN' is shown. If the card is poorly attached, the message 'LOOSE' is shown.
Card size	indicates the total amount of disk space in the card in kilobytes.
Card used	indicates the total amount of used disk space in the card in kilobytes.
Card full	indicates whether all the disk space in the card is used. Possible values are YES and NO.
Card empty	indicates the lack of menu files in the MENU card or no files in the DATA card. Possible values are YES and NO.
Read error	indicates whether the reading from the card has failed. Possible values are YES and NO.
Write error	indicates whether the writing to the card has failed. Possible values are YES and NO.

All values can be '- - -' to indicate 'No data available'.

1.4.2 Communication

Interface status indicates the status of the data link between the monitor and memory module. If the memory module is properly attached, the status should always be on ACTIVE. If the status blinks between ACTIVE and CLOSED, a communications error has occurred: remove the module briefly, and insert it back to the monitor frame to check if the error disappears.

Message types indicates the type of data packets that have been sent (**Tx**) and received (**Rx**) since last monitor start. Data types are listed on the lines below **Message types** text.



```
Communication

Interface status   ACTIVE

Message types          Tx        Rx
Record K                0         0
File Op.                0         0
Service                 0         0
Modes                   0         0
Module status         428       423
Packets total         428       423
Bytes total         30866     41922

Timeouts     0
Chksum err   0
Length err   0
Duplicated   0
```

Data types:

Record K	indicates the communication between the Monitor and Record Keeper.
File Operation	indicates the operations of Patient data.
Service	indicates the Memory Module operations.
Modes	indicates the User Mode operations.
Module status	indicates the number of sent/received data packets that relate to the memory module status.
Packets total	indicates the total amount of data packets that have been sent/received since the last monitor start.
Bytes total	indicates the total amount of data bytes that have been sent/received since the last monitor start.

The last four lines indicate transmission errors:

Timeouts	indicates the number of timeouts that have occurred in memory module data transmission since the last monitor start.
Chksum err	indicates the number of checksum errors in data packets from memory module since the last monitor start.
Length err	indicates the number of data packets with erroneous length from the memory module since the last monitor start.
Duplicated	indicates the number of duplicate data packets from the memory module since the last monitor start.

1.5 Power Supply

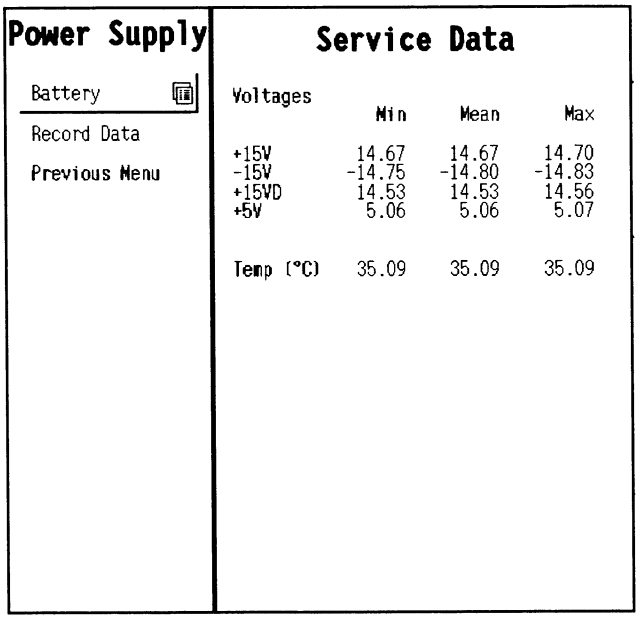
The menu shows the voltages and temperature measured by the UPI4(NET) board. The measurement starts about 100 ms after a start-up. The values in the column under **Mean** are the mean values of the last one second, the **Min** column shows the minimum mean value, and the **Max** column the maximum mean value of the voltages and temperature measured during the current power ON.

The voltages should meet the following ranges:

+15V	14.20....15.60
-15V	-14.00...-15.50 V
+15VD	14.10...15.60 V
+5V	4.70...5.40 V

Temp (°C) value corresponds with the Central Unit internal temperature measured at the location of the UPI4(NET) board.

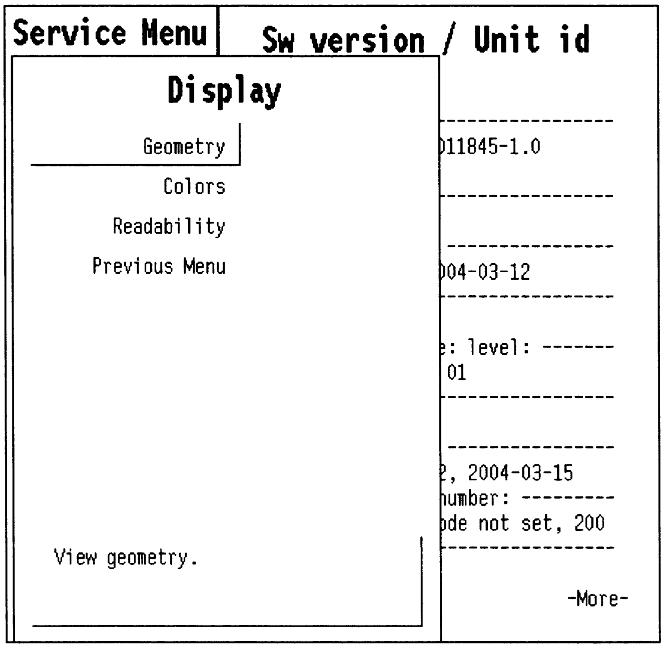
The numbers on this page are only directive and not absolute values.



```
Service Data

Voltages
                Min      Mean      Max

+15V          14.67     14.67     14.70
-15V         -14.75    -14.80    -14.83
+15VD         14.53     14.53     14.56
+5V            5.06      5.06      5.07

Temp [°C]     35.09     35.09     35.09
```

2 Display

Geometry views the geometry of the display.
Colors views the color of the screen.
Readability views the readability of the screen.


Service Menu
Sw version / Unit id
Display
Geometry
Colors
Readability
Previous Menu
-More-

```
----------------
)11845-1.0
----------------

 ----------------
)04-03-12
----------------

: level: -------
 01
----------------

 ----------------
, 2004-03-15
umber: ---------
de not set, 200
----------------
```

View geometry.

3 Keyboard

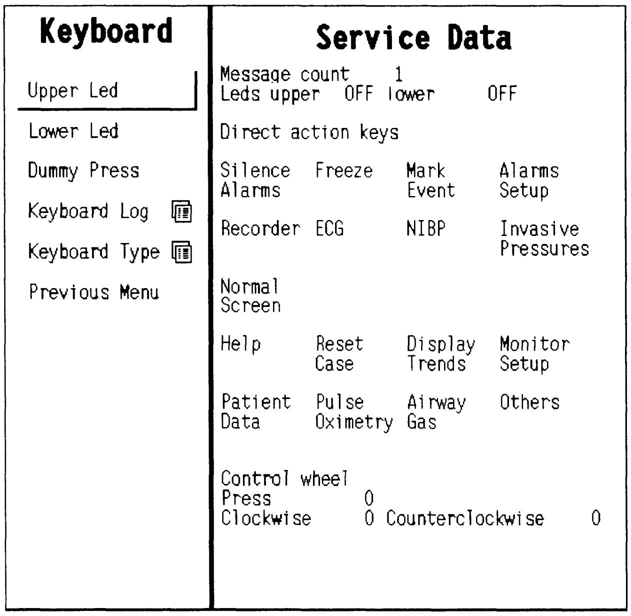
Keyboard

The service menu for testing the command board functions.

Upper Led is for testing the upper alarm LED (red) on the command board. When the text is highlighted, the upper alarm LED can be turned on and off by pressing the ComWheel.

Lower Led is for testing the lower alarm LED (yellow) on the command board. When the text is highlighted, the lower alarm LED can be turned on and off by pressing the ComWheel.

Dummy Press is for testing the ComWheel. When the text is highlighted, pressing the ComWheel creates a sound from the loudspeaker and the corresponding number on the service data field increases.



```
Service Data
Message count     1
Leds upper   OFF lower     OFF
Direct action keys
Silence   Freeze    Mark     Alarms
Alarms              Event    Setup
Recorder  ECG       NIBP     Invasive
                             Pressures
Normal
Screen
Help      Reset     Display  Monitor
          Case      Trends   Setup
Patient   Pulse     Airway   Others
Data      Oximetry  Gas

Control wheel
Press          0
Clockwise      0 Counterclockwise     0
```

Service Data

Message count counts the number of messages that are sent out to the main CPU board.

Leds upper and **lower** indicate the states of the alarm LEDs on the command board.

Direct action keys texts are indications to the command board membrane keys. When a key on the command board is pressed, the corresponding text in the menu changes its colour.

Control wheel, **Press** counts the ComWheel pressings.

Control wheel, Clockwise and **Counter clockwise** indicate the ComWheel turnings.

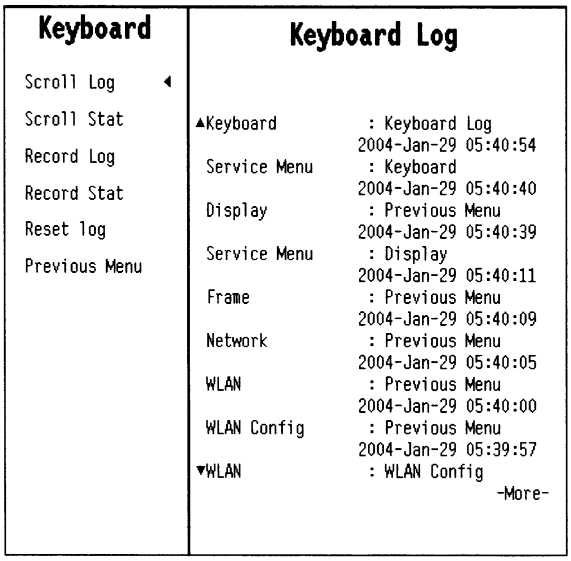
Since shows the date and the time of the last run time reset.

3.1 Keyboard Log

Keyboard Scroll Log

All the keyboard presses and the commands given by the ComWheel are recorded in the Keyboard Log. The keyboard log is saved in the permanent memory of the monitor. The length of the log is 1150 events. The log is FIFO type.

Scroll Stat enables to scroll the keyboard events.


Keyboard
Scroll Log
Scroll Stat
Record Log
Record Stat
Reset log
Previous Menu
Keyboard Log

```
▲Keyboard           : Keyboard Log
                   2004-Jan-29 05:40:54
 Service Menu       : Keyboard
                   2004-Jan-29 05:40:40
 Display            : Previous Menu
                   2004-Jan-29 05:40:39
 Service Menu       : Display
                   2004-Jan-29 05:40:11
 Frame              : Previous Menu
                   2004-Jan-29 05:40:09
 Network            : Previous Menu
                   2004-Jan-29 05:40:05
 WLAN               : Previous Menu
                   2004-Jan-29 05:40:00
 WLAN Config        : Previous Menu
                   2004-Jan-29 05:39:57
▼WLAN               : WLAN Config
                                  -More-
```

3.2 Keyboard Type

Store Mask A selection for the anaesthesia keyboard's language. The selected language determines the outcome of the lower keypad.

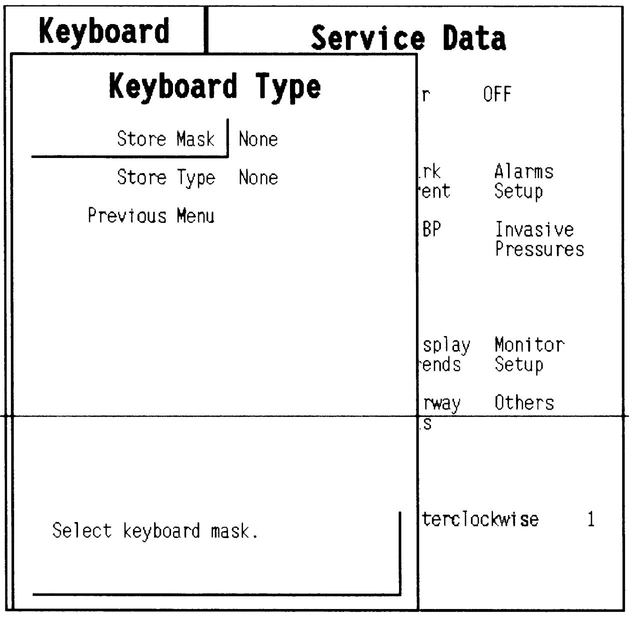
Store Type is for selecting the keyboard;

COM = Command Board

ARK = Anaesthesia Keyboard

AIC = Information Center Keyboard

NOTE: The settings should be checked if the controller board is replaced. If settings are changed, the new settings will not be valid until the next start-up.

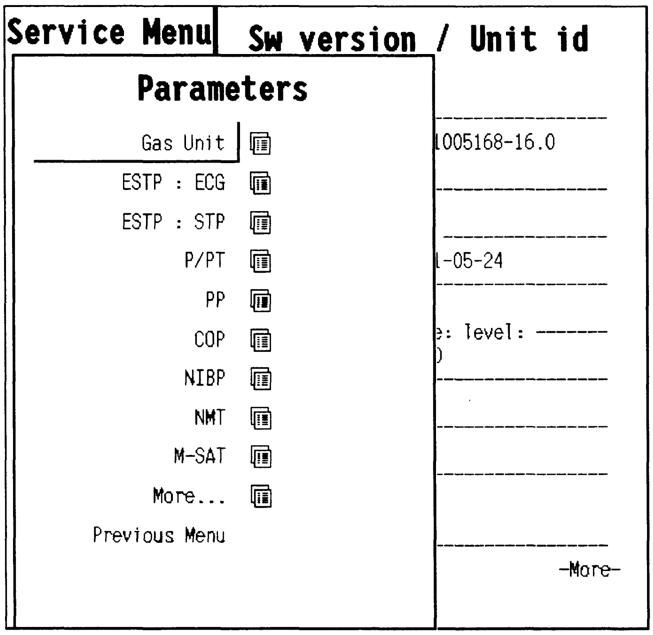

Keyboard
Service Data
Keyboard Type
Previous Menu
r
OFF
rk
ent
Alarms
Setup
BP
Invasive
Pressures
splay
ends
Monitor
Setup
rway
s
Others
terclockwise
1

Store Mask None
Store Type None

Select keyboard mask.

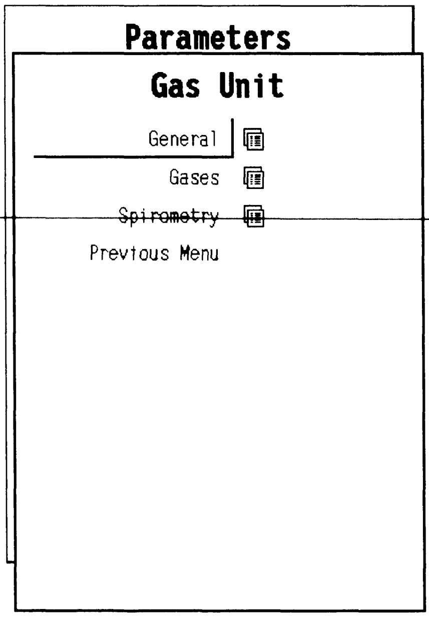
4 Parameters

NOTE: Parameter values in Service Data fields are only for reference in this section.


Service Menu
Sw version / Unit id
Parameters
Gas Unit
ESTP : ECG
ESTP : STP
P/PT
PP
COP
NIBP
NMT
M-SAT
More...
Previous Menu
005168-16.0
-05-24
: level:
-More-

4.1 Gas Unit

Service menu for airway gas modules' communication and airway gas and spirometry measurements.


Parameters
Gas Unit
General
Gases
Spirometry
Previous Menu

4.1.1 General

Service Data

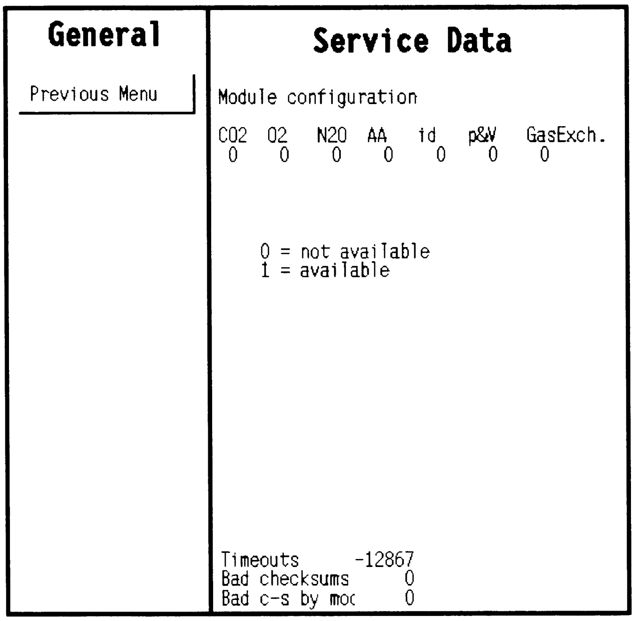
Module configuration shows which measurement options are available, i.e. are detected by the module.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.

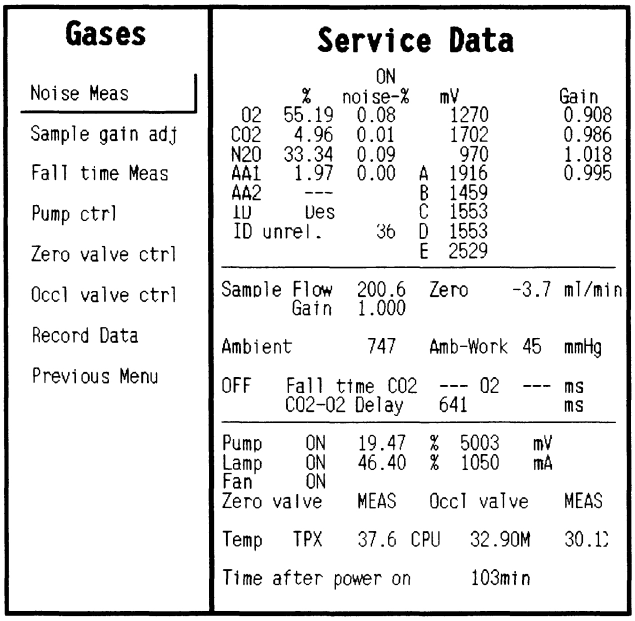
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame. The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.



```
Module configuration

C02  02   N20  AA   id   p&V   GasExch.
 0    0    0    0    0    0     0


     0 = not available
     1 = available


Timeouts       -12867
Bad checksums      0
Bad c-s by moc     0
```

4.1.2 Gases

Noise Meas	activates the noise measurement.
Sample gain adj	adjusts the sampling pump gain, i.e. for adjusting the sample flow measurement.
Fall time Meas *	activates the fall time measurement.
Pump ctrl	A manual control for the sampling pump.
Zero valve ctrl	A manual control for the zero valve.
Occl valve ctrl*	A manual control for the occlusion valve.
Record Data	prints out the shown service data and board information (id. serial number and software id.) onto the recorder module.



```
                 ON
        %     noise-%   mV          Gain
  02  55.19   0.08      1270        0.908
 CO2   4.96   0.01      1702        0.986
 N2O  33.34   0.09       970        1.018
 AA1   1.97   0.00    A 1916        0.995
 AA2   ---            B 1459
 ID     Des           C 1553
 ID unrel.      36    D 1553
                      E 2529

Sample Flow  200.6   Zero      -3.7 ml/min
       Gain  1.000

Ambient        747   Amb-Work  45   mmHg

OFF   Fall time CO2   --- O2   ---  ms
      CO2-O2 Delay    641           ms

Pump     ON   19.47  %  5003   mV
Lamp     ON   46.40  %  1050   mA
Fan      ON
Zero valve    MEAS   Occl valve    MEAS

Temp   TPX    37.6 CPU   32.90M    30.1

Time after power on      103min
```

Service Data

O_2, CO_2, N_2O, AA

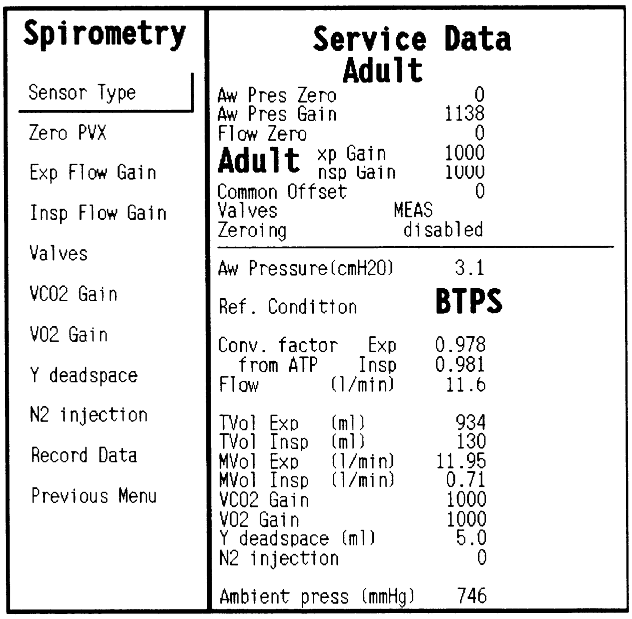
% field shows real-time concentrations.
noise-% is standard deviation of concentration.

O_2, CO_2, N_2O, AA channels A-E

mV field: signal is scaled to mV.
Gain: User gain. It is scaled as (User gain)/(Factory gain).

ID*	Shows the identified agent.
ID unrel.*	The shown value tells how unreliable the identification is. With pure agent the value is typically < 75.
Sample Flow	is calculated from differential pressure and adjusted by the module. **Zero** value as measured during initialization when the pump is off. **Gain**: sample flow measurement can be calibrated by adjusting the gain.
Ambient*	Ambient pressure is measured continuously in E-miniC. In M-miniC it is measured at least once an ~~hour (during the first running hour during each zeroing process). In M-Gas it is measured once an~~ hour . **Amb-Work**: ambient pressure - sampling system internal pressure.
Fall time*	CO_2 and O_2 in ms. For N_2O and AA same as CO_2.
CO_2-O_2 Delay*	In ms. No delay between CO_2, N_2O, and agents.
Pump	Can be toggled ON/OFF. PWM output 0-100% is shown. Pump voltage is also shown.
Lamp	The state, PWM control, and current of the lamp are shown.
Fan*	The state of the fan is shown.
Zero and Occl valve	Can be toggled between the measurement state (MEAS) and zeroing/occlusion states (ZERO/OCCL).
Temp	Temperatures measured by the module from TPX, CPU, and OM.
Time after power on	In minutes after power on.
***)**	The function is only in use with Compact Airway Modules.

4.1.3 Spirometry



```
Spirometry

Sensor Type
Zero PVX
Exp Flow Gain
Insp Flow Gain
Valves
VCO2 Gain
VO2 Gain
Y deadspace
N2 injection
Record Data
Previous Menu
```

```
     Service Data
        Adult
Aw Pres Zero                0
Aw Pres Gain             1138
Flow Zero                   0
Adult xp Gain            1000
      nsp Gain           1000
Common Offset               0
Valves               MEAS
Zeroing               disabled

Aw Pressure(cmH2O)        3.1
Ref. Condition          BTPS

Conv. factor   Exp      0.978
  from ATP     Insp     0.981
Flow          (l/min)    11.6

TVol Exp      (ml)        934
TVol Insp     (ml)        130
MVol Exp      (l/min)   11.95
MVol Insp     (l/min)    0.71
VCO2 Gain                1000
VO2 Gain                 1000
Y deadspace (ml)          5.0
N2 injection                0

Ambient press (mmHg)      746
```

Insp and exp flow gains can be adjusted, if calibration is needed. A calibration pump or spirometry tester is used and readings are observed from the display. If a deviation exists, gains are adjusted accordingly. Gain scaling is 1.000, when the factory settings are in effect (1.050 in modules that contain the Gas Exchange measurement).

When the Adjust key is pressed, a separate box for adjusting the value appears. During adjustment calibration, values are sent to the module. When the ComWheel is pressed, the values are permanently stored in EEPROM of the module and the box disappears.

Zero PVX: Start zeroing the pressure sensors. Effects Aw Pres Zero and Flow Zero value.

Exp Flow Gain / Insp Flow Gain: Adjust the Flow sensor gains.

Valves: Switch between MEASUREMENT and ZEROING

VCO2 / VO2 Gain: Adjust the VCO_2 and VO_2 gain.

Y deadspace: Adjust the Y-deadspace.

N2 injection: Select between on (1) and off (0).

Record Data: Record Data prints out the shown service data and board information (id. serial number and software id.) onto the recorder module.

Service Data

Sensor ADULT/PEDIATRIC according to the selected measurement mode (sensor).

Insp/Exp Flow Gains shown apply to the selected sensor.

Aw Press Zero and **Flow Zero** are the result of zeroing in the user service menu. They can be adjusted in the factory calibration menu, but not permanently stored.

Aw Press Gain is directly the value used in sw. It can be adjusted, but not permanently stored.

Exp Flow and **Insp Flow Gains** are scaled as (User gain)/(Factory gain). **Exp** and **Insp Flow Gains** can be adjusted also in the user service menu.

Common Offset is the compensation factor for pressure difference reading of the difference sensor when applying a equal pressure on both sides of the sensor.

Valves can be changed between **MEASUREMENT** and **ZEROING**.

Zeroing automatic zeroing either **ENABLED** or **DISABLED** (only factory service menu).

Aw Pressure shows the real time value of airway pressure.

Condition shows in which reference conditions the results are. With calibration pump or spirometry tester, the results are always in ATP. If breathing is detected ($EtCO_2$ > 1.0%), the results are according to the **Flow & Vol Setup** selection.

Flow shows the flow measurement value.

TVol Exp, TVol Insp, MVol Exp and **MVol Insp** are shown to ease calibration. The numbers are the same as on the main display. The former pump calibration procedure has been dropped out. We claim that calibration is not needed in routine clinical use, so a separate Flow calibration menu is not needed. Calibration can be done with the pump or spirometry tester. The results must be taken from the screen and gains adjusted accordingly.

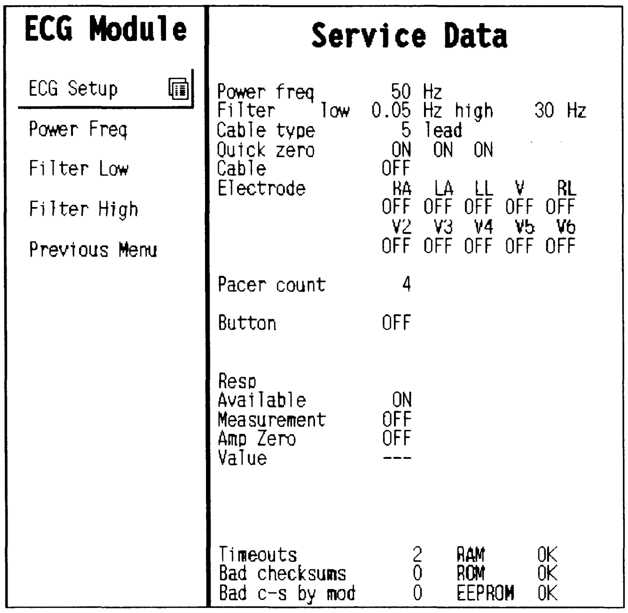
VCO_2 and **VO_2 Gain** show a value near 1000, the correct gains have been measured in the factory.

Y deadspace is the geometric volume in ml between the Y-piece and the D-lite. Default is 5 ml for a standard Y-piece (as delivered with Siemens 900C ventilators). Used for VCO_2 and VO_2 delay time corrections.

Set **N_2 injection** to 1 during laboratory tests with a Spirometry tester and injection of N_2 gas (for scientific validations use only). At power on of the module, the value is always zero.

Ambient pressure value measured by the module.

4.2 ECG Module



```
Power freq          50 Hz
Filter     low    0.05 Hz high     30 Hz
Cable type           5 lead
Quick zero          ON  ON  ON
Cable              OFF
Electrode           RA  LA  LL   V   RL
                   OFF OFF OFF OFF OFF
                    V2  V3  V4  V5  V6
                   OFF OFF OFF OFF OFF

Pacer count          4

Button             OFF


Resp
Available           ON
Measurement        OFF
Amp Zero           OFF
Value              ---



Timeouts              2   RAM     OK
Bad checksums         0   ROM     OK
Bad c-s by mod        0   EEPROM  OK
```

Power freq: Set power frequency; 50 Hz/60 Hz.

Filter low: Set filter low frequency; 0.05 Hz/0.5 Hz.

Filter high: Set filter high frequency; 30 Hz (40 Hz if power freq is 60 Hz) / 100 Hz or 150 Hz @ NE12STPR.

Service Data

Power freq, and Cable type show the values chosen or detected, **Filter low and high** defines the selected filter (Monitor/Diagnostic/ST).

Quick zero at PRESTN module is ON when the ECG signal is beyond scale, and therefore, is quickly returned to optimal range using fast signal processing methods. All the **Quick zero** bits are ON at the same time.

Cable shows ON when ECG cable is connected.

Electrode shows ON when each of these electrodes are connected.

Pacer count is a running number for pacemaker users.

Button No effect on the module.

Resp Available indicates that ECG hardware is capable of measuring impedance respiration.

Measurement shows ON when the respiration measurement is on.

Amp zero shows ON when zeroing of the respiration amplifier takes place.

Waveform **VALUE** will be updated in one second interval.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry. **Bad checksums** is a cumulative number that indicates how many times communication from the module to the monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.

The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.

ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.

EEPROM indicates if the values stored in the permanent memory are valid.

The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.2.1 ECG Setup

Filter filters the ECG signal high frequency noise and slow respiratory artefacts.

Monit (monitor) filter is used in routine monitoring. It effectively filters the artefacts caused by the electrosurgery unit and respiration.

Diagn (diagnostic) filter is used if more accurate information of the waveform is needed (e.g. of P-wave or AV block). The diagnostic filter is more susceptible both to high frequencies and baseline wander than the monitor filter.

STfilt (ST filter) permits more accurate information of ST segment. It filters the high frequency artefacts caused by the electrosurgery unit, but catches the slow changes in ST segment. The ST filter is more susceptible to baseline wander than the monitor filter.

5-lead cable selects five or three electrodes. With the 12-lead ECG the selection is automatic.

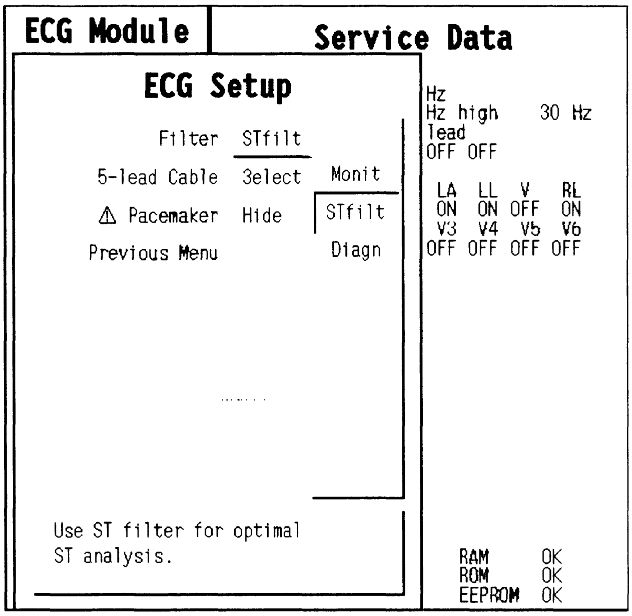
Pacemaker selects how to display the pacing pulse of cardiac pacemaker. The selections are **Show, Hide, ON R** and **Sensit.**

Hide, the pacing pulse is filtered away from ECG data.

Show, the pacer pulse is filtered away from ECG data but the pulse is displayed as a constant height marker.

ON R, pacing pulses are not filtered away from ECG data. This improves ECG monitoring with A-V pacemaker patients, as QRS complexes are counted even if the pacing pulse hits the QRS complex. However, during asystole the monitor may count pacing pulses as heart beats.

Sensit selection uses a more sensitive pacemaker detection. Pacemaker spike is displayed on ECG.



```
Filter         STfilt
5-lead Cable   3elect
⚠ Pacemaker    Hide

Use ST filter for optimal
ST analysis.

Hz
Hz high     30 Hz
lead
OFF OFF

 LA   LL   V    RL
 ON   ON  OFF   ON
 V3   V4   V5   V6
OFF  OFF  OFF  OFF

RAM       OK
ROM       OK
EEPROM    OK
```

4.3 ESTP Module

Service menu for the multiparameter hemodynamic module's oxygen saturation, invasive pressure and temperature measurements.

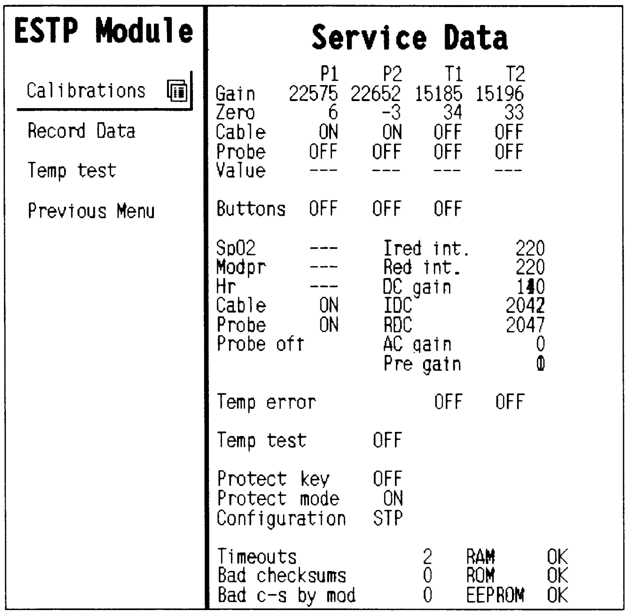
NOTE: Pressure Module, M-P and Pressure Temperature Module, M-PT have their own service menu; "4.4P/PT." and so does Dual Pressure Module, M-PP; "4.5PP."

Calibrations opens a submenu for temperature (T1, T2) and pressure (P1, P2) calibrations.

Record Data prints out the shown service data and board information (id, serial number and sw id) onto the recorder module.

Temp Test activates the automatic temperature test for the temperature channels T1 and T2. The result from the test is shown in the service data field.

NOTE: The Temp Test needs to be selected twice before the test starts.



```
Service Data

              P1     P2     T1     T2
Gain       22575  22652  15185  15196
Zero           6     -3     34     33
Cable         ON     ON    OFF    OFF
Probe        OFF    OFF    OFF    OFF
Value        ---    ---    ---    ---

Buttons      OFF    OFF    OFF

Sp02         ---    Ired int.      220
Modpr        ---    Red int.       220
Hr           ---    DC gain        140
Cable         ON    IDC           2042
Probe         ON    RDC           2047
Probe oft           AC gain          0
                    Pre gain         0

Temp error                 OFF    OFF

Temp test           OFF

Protect key         OFF
Protect mode         ON
Configuration       STP

Timeouts                 2   RAM      OK
Bad checksums            0   ROM      OK
Bad c-s by mod           0   EEPROM   OK
```

Service Data

Gain is a coefficient to compensate gain error. Usually the values for P1 and P2 are between 17000 and 25000 and for T1 and T2 between 13000 and 14300.

Zero indicates the offset compensation value of each parameter in the A/D converter. Typically the values for P1 and P2 are within ±1000 and for T1 and T2 between -150 and +300. Calibrate if zero and/or gain value is outside the ranges.

Cable shows ON when a corresponding cable is connected to the front panel and **Probe** shows ON when a corresponding probe is connected to the cable.

Under **Value**, the measured numeric values are displayed simultaneously. Pressure values are real time values and shown in mmHg. Temperature values are shown in degrees Celsius.

The front panel STP keys functions are confirmed by pressing each key and observing that OFF turns to ON at **Button**.

$Sp0_2$ shows the measured beat-to-beat $Sp0_2$ value. **Modpr** is a modulation % that indicates the AC/DC ratio in the measured signal. **Hr** is a pulse rate calculated from every beat.

Cable and **Probe** can be either OFF or ON, and these indicate the state PROBE OFF.
Under them there is a **message field for $Sp0_2$**. It can be OK, PULSE SEARCH, NO PROBE, PROBE OFF, NO PULSE, ARTEFACT, POOR SIGNAL, or CHECK PROBE.

Balance between leds is adjusted by changing the intensity of red/infrared. Intensity of infrared (**Ired int.**) is in the range of 40 to 255 and red intensity (**red int.**) is in the range of 40 to 255.

DC gain shows the gain of DC signal adjusted by the module.

IDC is the value of infrared signal.

RDC is the dc value of red signal.

AC gain is the gain of infrared and red ac signals. AC gain values can be 1 or 0. Value 1 means high ac gain and 0 means low gain.

Pre gain is a preamplifier gain for infrared and red signals. Pre gain values can be 1 or 0. Value 1 means normal operation. Value 0 means that signal levels are very low and extra gain is taken into use.

Temp error shows the status of the temperature test. No errors found show the status (OFF) and errors found (ON).
Protect key shows normally OFF, but turns to ON when the button at the bottom of the module is pressed.
Protect mode is normally ON. It turns to OFF, when Protect is switched to OFF for the temperature calibration in Calibration Menu.
Configuration shows the chosen module configuration: TP, ST, or STP.

Timeouts is a cumulative number that indicates how many times the module has not responded to the the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

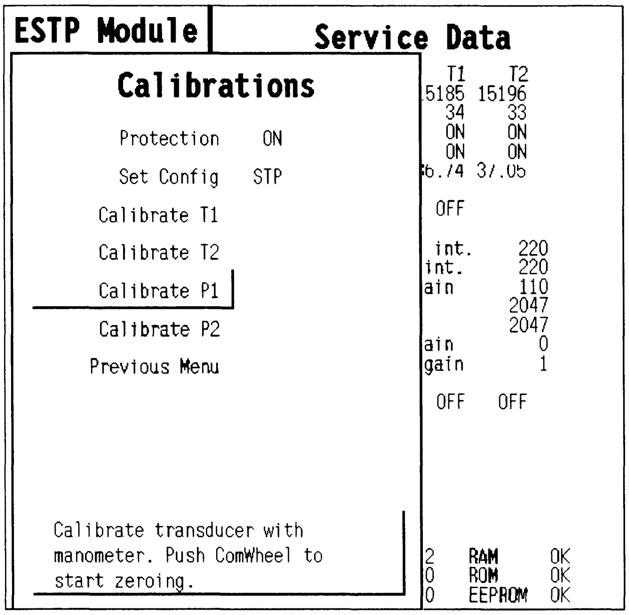
4.3.1 Calibrations

Protection: Protection for the configuration and temperature calibrations can be set ON and OFF.

Set Config: The module configuration should be set according to the module type. The setting is possible only when the protection is set OFF. The available selections are TP, ST or STP. The configuration setting should be checked, if the STP board is replaced.

Calibrate T1 / Calibrate T2: The functions are for calibrating the temperature channels T1 and T2.

Calibrate P1/ Calibrate P2: The functions are for calibrating the invasive blood pressure channels P1 and P2.



```
ESTP Module          Service Data
    Calibrations                    T1     T2
                                   5185  15196
    Protection     ON                34     33
    Set Config     STP               ON     ON
    Calibrate T1                     ON     ON
    Calibrate T2                   6.74  37.05
    Calibrate P1                    OFF
    Calibrate P2                    int.     220
    Previous Menu                  int.      220
                                   ain       110
                                            2047
                                            2047
                                   ain         0
                                   gain        1
                                    OFF    OFF

  Calibrate transducer with        2   RAM     OK
  manometer. Push ComWheel to      0   ROM     OK
  start zeroing.                   0   EEPROM  OK
```

How to calibrate T1/ T2

The calibrations are possible only when the protection is set ***OFF***. The temperature calibration requires accurate test plugs of value 25 °C and 45 °C.

1. Select ***Calibrate T1/Calibrate T2***
2. Insert the test plug 25 °C into the T1/T2 connector
3. Press the ComWheel
4. Insert the test plug 45 °C into the T1/T2 connector
5. Press the ComWheel

How to calibrate P1/ P2

The calibrations require a pressure transducer (with appropriate cable) and a pressure manometer.

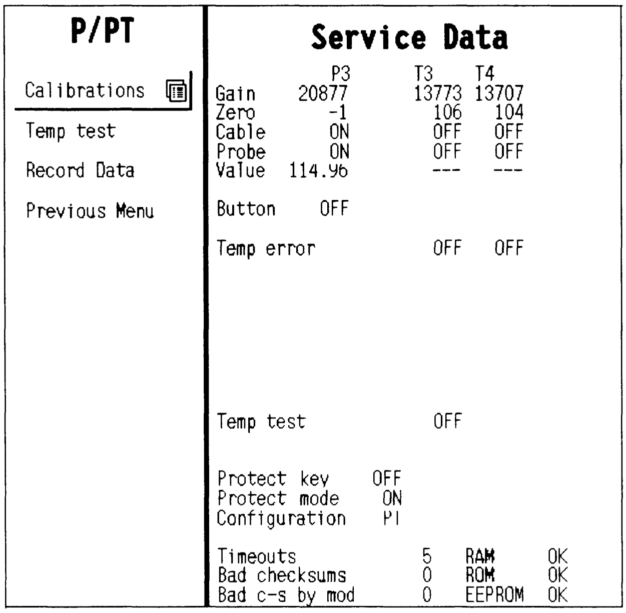
1. Connect the pressure transducer with the pressure manometer to the P1/P2 connector. Select ***Calibrate P1/Calibrate P2***. Leave the transducer to room air pressure.
2. Press the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel.

4.4 P/PT

Service menu for Pressure Module, M-P and Pressure Temperature Module, M-PT.

Calibrations: see section "P/PT Calibrations."

Record Data: Record Data prints out the shown service data and board information (id., serial number, and software id.) onto the recorder module.



```
P/PT                 Service Data

Calibrations            P3        T3    T4
                 Gain   20877     13773 13707
Temp test        Zero      -1       106   104
                 Cable     ON       OFF   OFF
Record Data      Probe     ON       OFF   OFF
                 Value  114.96      ---   ---
Previous Menu
                 Button    OFF

                 Temp error         OFF   OFF



                 Temp test          OFF

                 Protect key     OFF
                 Protect mode     ON
                 Configuration    PT

                 Timeouts          5   RAM     OK
                 Bad checksums     0   ROM     OK
                 Bad c-s by mod    0   EEPROM  OK
```

Service Data

Gain is a coefficient to compensate gain error. Usually the value for P3 is between 17000 and 25000 and for T3 and T4 between 13000 and 14300.

Zero indicates the offset compensation value of each parameter in the A/D converter. Typically the values for P3 are within ±1000 and for T3 and T4 between -150 and +300. Calibrate if the zero and/or gain value is outside the ranges.

Cable shows ON when the corresponding cable is connected to the front panel.

Probe shows ON when the corresponding probe is connected to the cable.

Under **Value**, the measured numeric values are displayed simultaneously. The pressure value is a real time value and shown in mmHg.

Button; the front panel key function can be confirmed by pressing the key and checking that OFF turns to ON.

Temp error shows whether the calibration of the temperature was successful or not.

Protect key shows normally OFF but turns to ON when the button at the bottom of the module is pressed.

Protect mode is normally ON. It turns to OFF when Protect is switched to OFF for the temperature calibration in Calibration Menu.

Configuration shows the chosen module configuration: BP or PT.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is also a cumulative number that indicates how many times communication from the module to monitor has broken down.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.

The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory. ROM indicates whether the checksum in the EPROM is in accordance with the one the software has calculated. EEPROM indicates if the values stored in the permanent memory are valid. The state is either OK, Fail or ? (module not in place or a communication error).

4.4.1 P/PT Calibrations

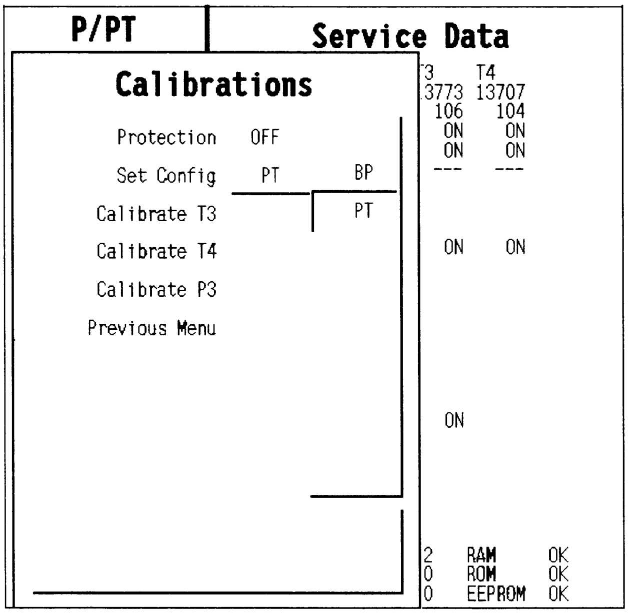
Protection for the configuration and temperature calibrations can be set ON and OFF only when the protect button at the bottom of the module is pressed.

Set Config: The module configuration should be set according to the module type. The setting is possible only when the protection is set OFF. The available selections are BP or PT.

The configuration setting should be checked, if the PT board is replaced.

Calibrate T3 and Calibrate T4: The functions are for calibrating the temperature channels T3 and T4.

Calibrate P3: The function is for calibrating the invasive blood pressure channel P3.



```
P/PT          Service Data
                               3      T4
   Calibrations                3773  13707
                                106    104
  Protection    OFF              ON     ON
                                 ON     ON
  Set Config    PT       BP      ---    ---
  Calibrate T3           PT
  Calibrate T4                   ON     ON
  Calibrate P3
  Previous Menu

                                 ON

                               2  RAM     OK
                               0  ROM     OK
                               0  EEPROM  OK
```

How to calibrate T3/ T4

The calibrations are possible only when the protection is set ***OFF.*** The temperature calibration requires accurate test plugs of value 25 °C and 45 °C.

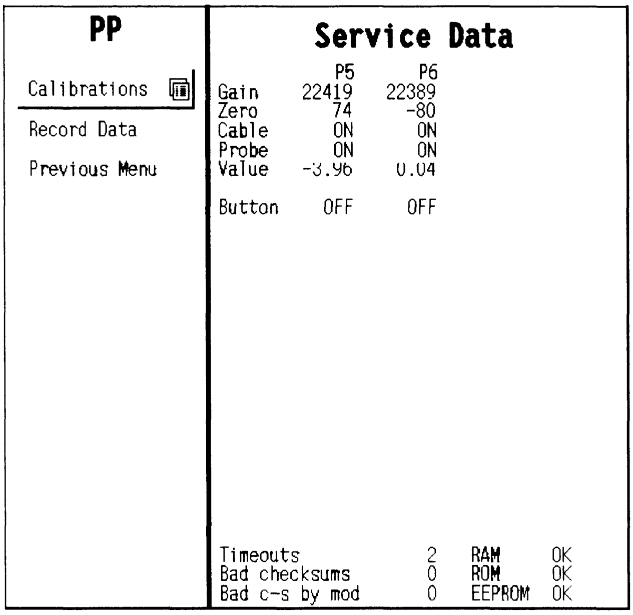
1. Select ***Calibrate T3 / Calibrate T4***
2. Insert the test plug 25 °C into the T3 / T4 connector
3. Press the ComWheel
4. Insert the test plug 45 °C into the T3 / T4 connector
5. Press the ComWheel

How to calibrate P3

The calibration requires a pressure transducer (with an appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P3 connector. Select ***Calibrate P3***. Leave the transducer to room air pressure.
2. Press the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel.

4.5 PP



```
Service Data
          P5      P6
Gain    22419   22389
Zero       74     -80
Cable      ON      ON
Probe      ON      ON
Value   -3.96    0.04

Button    OFF     OFF

Timeouts              2   RAM     OK
Bad checksums         0   ROM     OK
Bad c-s by mod        0   EEPROM  OK
```

Service menu for Dual Invasive Pressure Module, M-PP.

Calibrations: see section "PP Calibrations."

Record Data prints out the service data and circuit board information (id., serial number, and software id.) on the Recorder Module.

Service Data

Gain is a coefficient to compensate for gain error. Usually the values for P5 and P6 are between 17000 and 25000.
Zero indicates the offset compensation value for each parameter in the A/D converter. Typically the values for P5 and P6 are within ±1000. Calibrate if the zero and/or gain value is outside the ranges.

Cable shows ON when the corresponding cable is connected to the front panel and **Probe** shows ON when the corresponding probe is connected to the cable.

Value displays the measured numeric values simultaneously. The pressure value is a real time value and shown in mmHg.

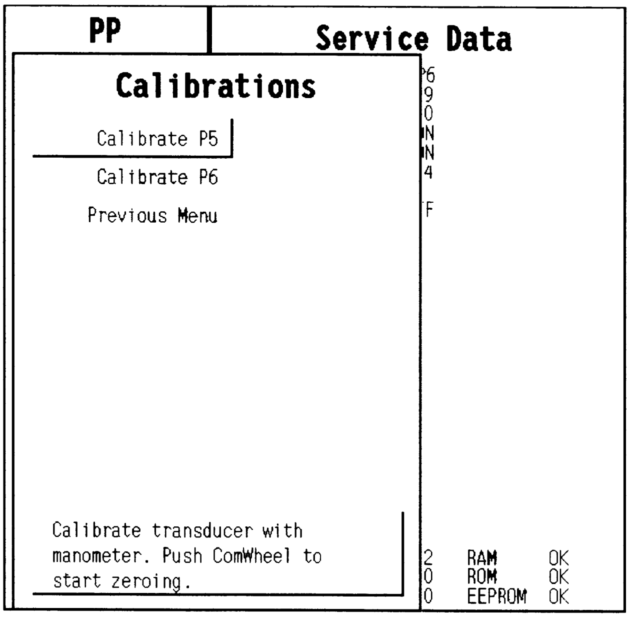
Button; the front panel key function can be confirmed by pressing the key and checking that OFF turns to ON.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory. **ROM** indicates whether the checksum in the EPROM is in accordance with the software calculated value. **EEPROM** indicates whether the values stored in the permanent memory are valid. The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.5.1 PP Calibrations

Calibrate P5 and Calibrate P6
These functions are for calibrating the invasive blood pressure channels P5 and P6.


PP
Service Data
Calibrations
Calibrate P5
Calibrate P6
Previous Menu
RAM OK
ROM OK
EEPROM OK

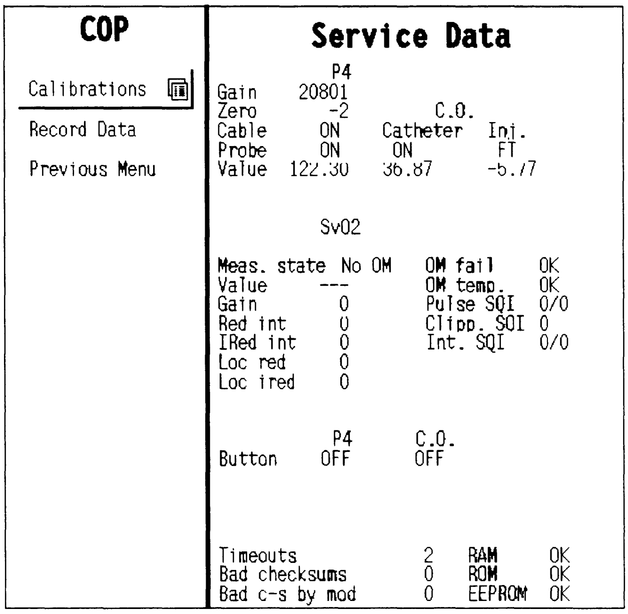
Calibrate transducer with manometer. Push ComWheel to start zeroing.

How to calibrate

The calibrations require a pressure transducer (with an appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P5 / P6 connector. Select Calibrate P5 / Calibrate P6. Leave the transducer at room air pressure.
2. Push the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and push the ComWheel.

4.6 COP



```
Service Data
              P4
Gain       20801
Zero          -2          C.O.
Cable         ON     Catheter   Inj.
Probe         ON      ON         FT
Value     122.30     36.87      -5.77

              SvO2

Meas. state  No OM     OM fail     OK
Value          ---     OM temp.    OK
Gain            0      Pulse SQI   0/0
Red int         0      Clipp. SQI  0
IRed int        0      Int. SQI    0/0
Loc red         0
Loc ired        0

              P4         C.O.
Button        OFF        OFF

Timeouts               2    RAM      OK
Bad checksums          0    ROM      OK
Bad c-s by mod         0    EEPROM   OK
```

Service menu for Cardiac Output Module, M-COP and Cardiac Output and Mixed Venous Oxygen saturation (SvO2) Module, M-COPSv.

Record Data prints out the service data and module information (id. serial number and software id.) on the Recorder Module.

Service Data

P4

Gain is a coefficient to compensate for gain error. Typically the value is between 17000 and 25000. Calibrate if the zero and/or gain value is outside the ranges.

Zero indicates the offset compensation value of each parameter in the A/D converter. Usually the value is within ±1000.

Cable shows ON when the corresponding cable is connected to the front panel and **Probe** shows ON when the corresponding probe is connected to the cable.

Value shows the measured numeric values simultaneously. The pressure value is a real time value and shown in mmHg.

Probe items **Catheter** (ON/OFF) and **Inj.** (FT, BATH, or OFF) indicate connections and **Value** indicates the measured temperatures in 0.01 °C increments.

SvO2

Meas. state: Measurement status shows: No optical module (No OM) connected, initializing the optical module (Init OM), normal measurement state (Normal) and failed module (OM fail).

Value is a measured SvO_2 value.

Gain is the gain of the remote red and infrared signals (0, 1, 2 or 3)

Red int: Reflected red intensity

Ired int: Reflected infrared intensity

Loc red: Local red intensity

Loc ired: Local infrared intensity

OM fail: Reason why initialization OK (OK), cannot read EEPROM of the optical module correctly (EEPROM), cannot adjust LED current to get required local signal (Transmit).

OM temp: Temperature of the optical module OK (OK), temp under 43 °C (Under), temp over 47 °C (Over).

Pulse SQI: Signal quality index for pulsing (low pulse/high pulse). 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Clipp. SQI: Signal quality index for wall artifact. 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Int. SQI: Signal quality index for intensity shift from previous calibration or Hgb update (intensity decreased/increased) 0 indicates a normal signal, 1 indicates an intermediate signal, 2 indicates a poor signal, and 3 indicates an unacceptable signal.

Button: The front panel Zero P4 and Start C.O. key functions can be confirmed by pressing the key and checking that the relevant OFF message turns to ON.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.

The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.

The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the external RAM memory.

ROM indicates whether the checksum at the EPROM is in accordance with the software calculated value.

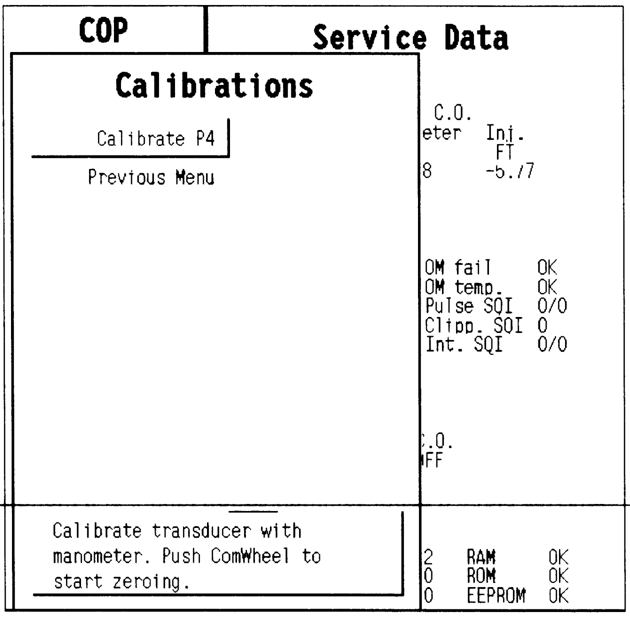
EEPROM indicates if the values stored in the permanent memory are valid.

The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.6.1 COP Calibrations

Calibrate P4

This function is for calibrating the invasive blood pressure channel P4.



```
OM fail      OK
OM temp.     OK
Pulse SQI    0/0
Clipp. SQI   0
Int. SQI     0/0
```

Calibrate transducer with manometer. Push ComWheel to start zeroing.

```
2   RAM      OK
0   ROM      OK
0   EEPROM   OK
```

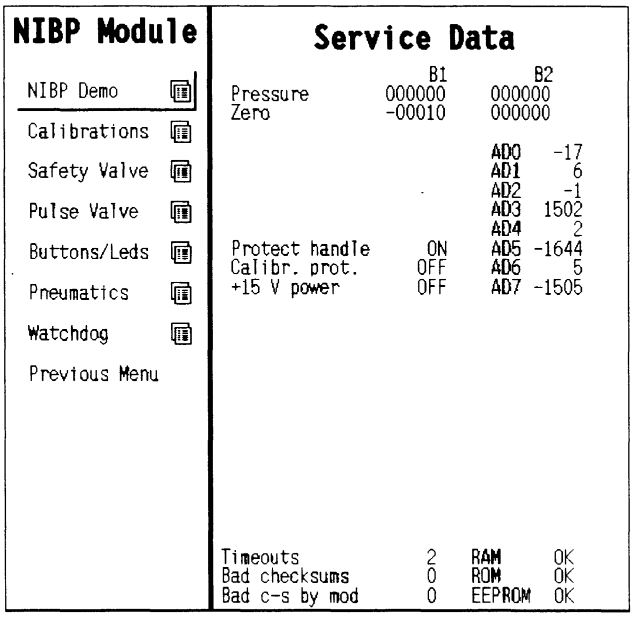
How to calibrate

The calibration requires a pressure transducer (with an appropriate cable) and a pressure manometer.

1. Connect the pressure transducer with the pressure manometer to the P4 connector. Select Calibrate P4. Leave the transducer at room air pressure.
2. Press the ComWheel to start zeroing.
3. Supply a pressure of 100 mmHg to 300 mmHg to the transducer. The recommended pressure is 200 mmHg.
4. Set the pressure on the display to match the pressure reading on the manometer and press the ComWheel.

4.7 NIBP Module

Service menu for Non-invasive Blood Pressure Modules.



```
                Service Data
                        B1        B2
Pressure            000000    000000
Zero                -00010    000000

                              AD0    -17
                              AD1      6
                              AD2     -1
                              AD3   1502
                              AD4      2
Protect handle          ON    AD5  -1644
Calibr. prot.          OFF    AD6      5
+15 V power            OFF    AD7  -1505

Timeouts              2    RAM      OK
Bad checksums         0    ROM      OK
Bad c-s by mod        0    EEPROM   OK
```

Service Data

Pressure shows the measured pressure multiplied by 10. This value is automatically zero-drift compensated.
Zero shows the difference between the zeroing value in the permanent memory (stored when the module is calibrated) and the current automatic zero-drift compensation multiplied by 10. The value can change between +20 and -20 mmHg. If the zero drift exceeds ± 10 mmHg, the module should be recalibrated.
Protect handle indicates hardware protection for EEPROM memory. It should be ON all the time in normal operation. If it is OFF, data cannot be read from or written to EEPROM, only the calibration protection can be set or reset by software. It can be turned to OFF by pressing the NIBP module buttons **Auto ON/OFF** and **Start Cancel** simultaneously for 3 seconds, which also enables ***Protection ON/OFF*** menu selection in the calibration menu.
Calibr. prot. shows software calibration protection and it should be OFF to enable calibration.
+15 V power refers to legacy NIBP modules. Not used in PRESTN series modules and E-PSM(P).

AD0 to **AD7** show the values of each eight channels of the A/D converter. AD7 is not used in the M-NIBP PRESTN series modules module .
Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The values may also be reset when a module is attached to the monitor frame and be set to 32769 or continuous counting may be started when the module is removed from the monitor frame.
The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) or value 32769 indicates either a serial communication failure or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum in the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

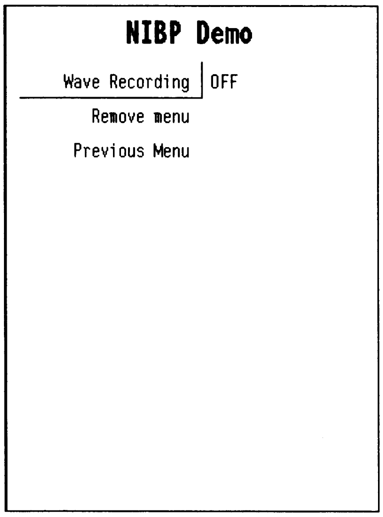
4.7.1 NIBP Demo

A service menu for demonstrating the oscillometric method of NIBP measurement. The menu shows the real-time pressure signals that are measured from the NIBP cuff. The measurement result is shown in the adjoining digit field.

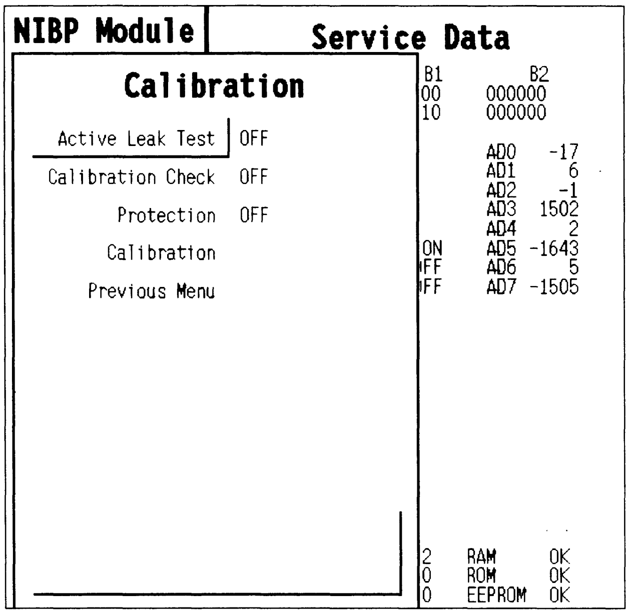
Wave Recording is for selecting the recording option. If ON is selected, the pressure signals are recorded in real-time onto the M-REC paper.

Remove menu widens the displayed waveform area.

The menu can be closed by selecting the **Previous Menu** or just by pressing the ComWheel if the **Remove menu** was selected.



4.7.2 NIBP Calibration



```
NIBP Module         Service Data
                                   B1        B2
       Calibration                 00    000000
                                   10    000000
   Active Leak Test  OFF
                                         AD0    -17
 Calibration Check   OFF                 AD1      6
                                         AD2     -1
        Protection   OFF                 AD3   1502
                                         AD4      2
       Calibration                 ON    AD5  -1643
                                   FF    AD6      5
     Previous Menu                 FF    AD7  -1505

                                   2   RAM      OK
                                   0   ROM      OK
                                   0   EEPROM   OK
```

Active Leak Test: Wrap an adult cuff around a pipe and connect the cuff to the module. Select the active leak test (ON). The module automatically pumps a pressure of 260 mmHg into the cuff. Wait for several seconds until the pressure stabilizes. Then check that the pressure reading does not drop more than 6 mmHg per minute. If it does, leaking point(s) should be detected and fixed. Cancel the test by selecting the Active leak test OFF.

Calibration Check: After the calibration check is selected (ON), the module zeroes the pressure transducers at the beginning of the calibration check. Do not pump pressure until the text 'Calibrating' appears in the NIBP digit field or the zeroing will fail. After the zeroing is done, manually pump pressure into the module and make sure that the same pressure values are shown both on the display and on the manometer. Pressure of both pressure channels B1 and B2 are shown. The pressure values are automatically zero-compensated, so the readings of B1 and B2 should be the same as the manometer readings.

Protection: Software calibration protection (ON/OFF). Select ***OFF*** when calibrating. ***Protection*** selection becomes available in the menu after pressing the NIBP module buttons **Auto ON/OFF** and **Start/Cancel** simultaneously for 3 seconds. For M-NE(12)STPR series modules: Protection can be set ON or OFF only when the toggle switch at the bottom module is set to the right.

How to Calibrate

Calibration selection is available only when protection is OFF.

NIBP calibration can be performed in the NIBP Service menu as follows:

NOTE: Both channels B1 and B2 must be calibrated simultaneously.

NOTE: The module must be in the frame during the whole procedure.

1. If ***Protection*** is ***ON***, change it to ***OFF*** by pressing the NIBP module buttons **Auto ON/OFF** and **Start Cancel** simultaneously for 3 seconds, which enables the ***Protection*** selection. Then press the buttons again for 3 seconds to enable ***Calibration***.

NOTE: When the buttons have been pressed, the NIBP field shows an error message 'Calibration switch on!'.

NOTE: For M-NE(12)STPR series modules: If ***Protection*** is ***ON,*** change it to ***OFF*** by first turning the toggle switch to the right at the bottom of the module, which enables the ***Protection*** selection. Then turn the toggle switch to the left to enable ***Calibration***. When the switch is at the right, the NIBP field shows an error message 'Calibration switch on!'

NOTE: When calibration is enabled, a message 'Calibration not protected' appears.

2. For proper zeroing to take place, remove the hose from the front panel connector. Select ***Calibration*** and push the ComWheel. Messages 'Zeroing' and 'Zeroed' will appear in the NIBP

message field. After this, a pressure bar will appear beside the menu and the text 'Calibrating' will appear in NIBP digit field.

3. Connect an external mercury manometer with a pump to the module through the both tubes of the hose. Pump up to about 200 mmHg pressure (range of 150 to 300 mmHg allowed) according to the manometer. Verify that both pressure values in the prompt field match the manometer reading. If not, adjust by turning the ComWheel.
4. When the values are equal, push the ComWheel to confirm the calibration. After a few seconds the 'Calibrated' message will appear in the NIBP digit field, which means that the calibration data has now been saved.

NOTE: When calibrating NIBP, always change the displayed pressure value slightly with the ComWheel, even in cases where the value would be correct. For example, change the value one step higher and then back one step lower. The 'Calibrated' text should appear in the display. This ensures that the calibration procedure is correctly registered and stored by the module.

5. Use the module buttons again to enable **Protection** setting and set it ON, and finally disable **Protection** setting.

4.7.3 NIBP Safety Valve

Test: Start test is for starting and **Stop test** is for stopping the Safety Valve test.

Safety Valve Data:

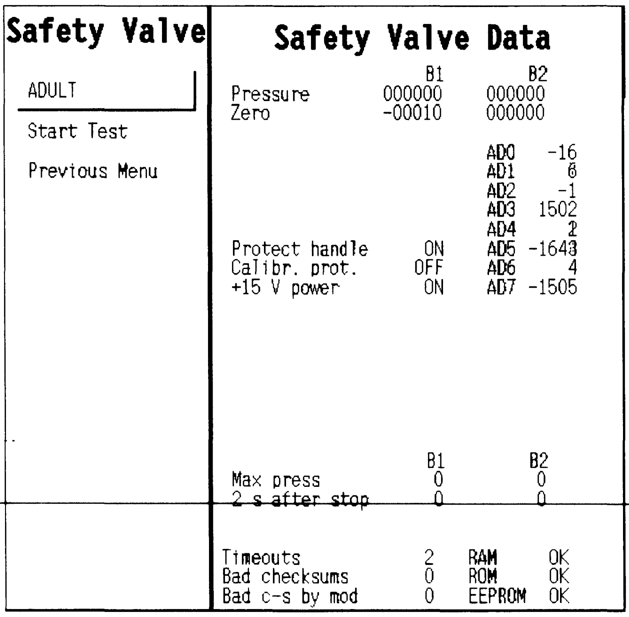
For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see service data descriptions in section 4.7 NIBP Module.

Max. press and **2 s after stop** show the measured values at Safety Valve test.

Safety Valve Test Adult/Infant

Wrap an adult cuff around a pipe and connect the cuff to the module. Highlight **Start test** and give the ComWheel a push. The test ends automatically or when **Stop test** (appears in place of **Start test**) is pushed.

Max. press indicates the pressure at which the safety valve opens and is normally 300 ±15 mmHg for adult and 150 mmHg ±15 mmHg for infant. **2 s after stop** indicates the pressure at 2 seconds after the pump has stopped and is normally > 270 mmHg for adult and > 130 mmHg for infant. If the value is less, check leakage by the active leak test.



```
Safety Valve Data
                      B1        B2
Pressure          000000    000000
Zero              -00010    000000

                            AD0    -16
                            AD1      6
                            AD2     -1
                            AD3   1502
                            AD4      2
Protect handle        ON    AD5  -1643
Calibr. prot.        OFF    AD6      4
+15 V power           ON    AD7  -1505

                      B1        B2
Max press              0         0
2 s after stop         0         0

Timeouts             2    RAM      OK
Bad checksums        0    ROM      OK
Bad c-s by mod       0    EEPROM   OK
```

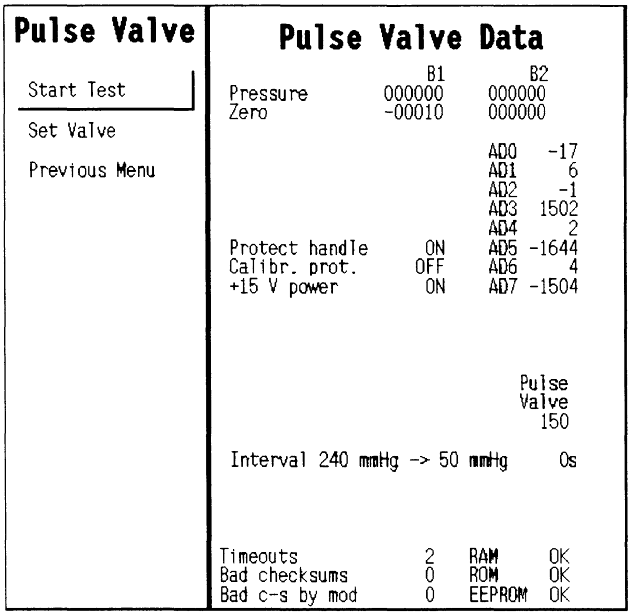
4.7.4 NIBP Pulse Valve

Start test is for starting and **Stop test** is for stopping the test.

Set Valve lets you adjust the opening of the pulse valve.

Pulse Valve Data

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "NIBP Module."



```
Pulse Valve Data
                          B1         B2
Pressure              000000     000000
Zero                  -00010     000000

                                 AD0    -17
                                 AD1      6
                                 AD2     -1
                                 AD3   1502
                                 AD4      2
Protect handle            ON     AD5  -1644
Calibr. prot.            OFF     AD6      4
+15 V power               ON     AD7  -1504


                                   Pulse
                                   Valve
                                     150

Interval 240 mmHg -> 50 mmHg          0s


Timeouts                   2   RAM     OK
Bad checksums              0   ROM     OK
Bad c-s by mod             0   EEPROM  OK
```

How to check Pulse Valve

Wrap an adult cuff around a pipe and connect the cuff to the module. Select **Start test** and push the ComWheel. The pressure rises beyond 240 mmHg and stops. The pulse valve opens. The module counts the time it takes for the pressure to go down from 240 mmHg to 50 mmHg and displays it on the screen. The test can be manually stopped by selecting **Stop test**.

The valve can be adjusted between 0 and 255 (0 for fully closed and 255 for fully open). First select **Set Valve** and push the ComWheel. See the pulse valve value and adjust it by turning the ComWheel. Then push the ComWheel to confirm the value.

The **Interval 240 mmHg -> 50 mmHg** time should be less than 60 seconds when the valve is 150 and less than 10 when fully opened (255). When fully closed (0), the system should be airtight and the pressure does not drop. Depending on an individual, the pulse valve may remain closed up to approx. value 100.

If the measured time deviates much from those above, then the pulse valve or its tubes are faulty.

4.7.5 NIBP Buttons/Leds

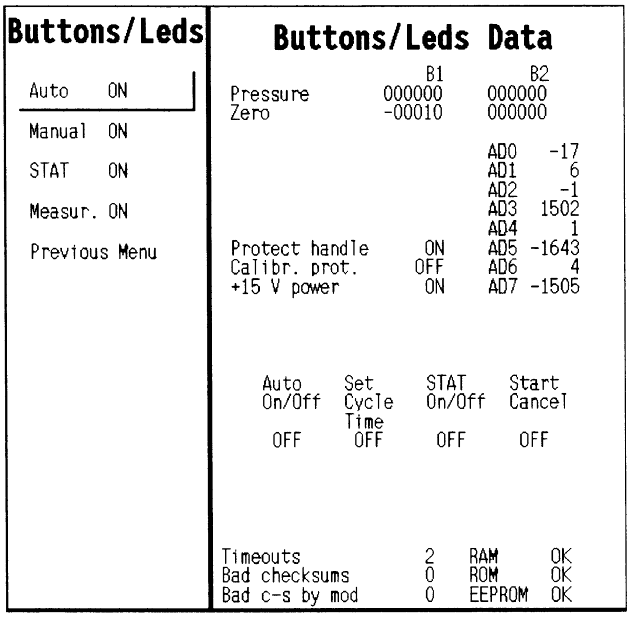
The selections ***Auto ON/OFF, Manual ON/OFF, STAT ON/OFF***, and ***Measur. ON/OFF*** have effect only on the NIBP module, M-NIBP.

Buttons/Leds Data

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "NIBP Module."

Buttons Checking

The front panel keys function is confirmed by pressing and releasing the key and observing that **OFF** turns to **ON** at **Auto On/Off**, and **Start Cancel**. Set Cycle Time and STAT On/Off are not in use with E-PSM(P).



```
Buttons/Leds   Buttons/Leds Data
                                         B1        B2
 Auto    ON     Pressure             000000    000000
                Zero                 -00010    000000
 Manual  ON
                                               AD0    -17
 STAT    ON                                    AD1      6
                                               AD2     -1
 Measur. ON                                    AD3   1502
                                               AD4      1
 Previous Menu  Protect handle           ON    AD5  -1643
                Calibr. prot.           OFF    AD6      4
                +15 V power              ON    AD7  -1505


                  Auto      Set      STAT      Start
                  On/Off    Cycle    On/Off    Cancel
                            Time
                  OFF       OFF      OFF       OFF


               Timeouts                 2   RAM     OK
               Bad checksums            0   ROM     OK
               Bad c-s by mod           0   EEPROM  OK
```

4.7.6 NIBP Pneumatics

Start Pump/Stop Pump: A manual control for the pump. The selection changes to **Stop Pump** when the pump turns on.

Open Exh1/Close Exh1: No effect on the module.

Open Exh2/Close Exh2: A manual control for the exhaust valve 2. The selection changes to **Close Exh2** when the valve is opened.

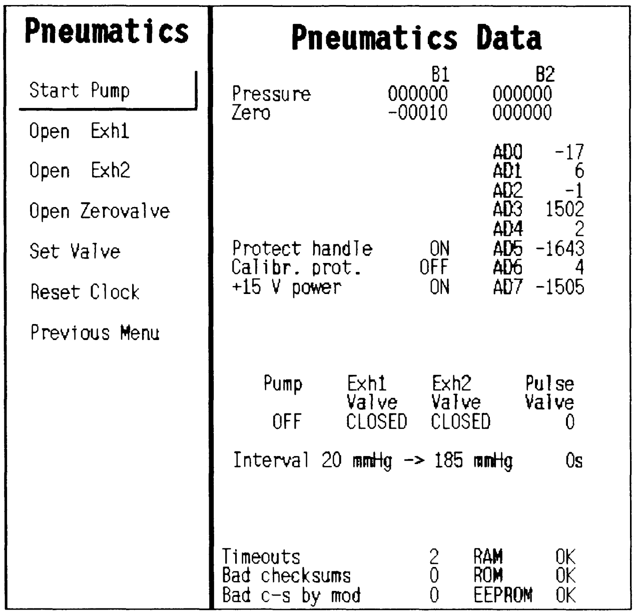
Open Zero valve: No effect on the module.

Set Valve: The opening of the pulse valve is adjusted between 0 and 255 (0 for fully closed and 255 for fully open). First push the ComWheel, then turn it to adjust the value on the screen and finally push to set the value.

Reset Clock will zero the time on the display, .

Pneumatics Data field

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "NIBP Module."



```
Pneumatics Data
                        B1        B2
Pressure            000000    000000
Zero                -00010    000000

                              AD0    -17
                              AD1      6
                              AD2     -1
                              AD3   1502
                              AD4      2
Protect handle          ON    AD5  -1643
Calibr. prot.          OFF    AD6      4
+15 V power             ON    AD7  -1505


   Pump     Exh1      Exh2      Pulse
            Valve     Valve     Valve
   OFF      CLOSED    CLOSED        0

Interval 20 mmHg -> 185 mmHg        0s


Timeouts              2    RAM      OK
Bad checksums         0    ROM      OK
Bad c-s by mod        0    EEPROM   OK
```

Pump, Exh1 Valve, and **Exh2 Valve** show their states. NOTE: **Exh1 Valve** has no effect on the module.

Pulse Valve shows how much the valve is opened (0 to 255) during Valve Setting.

How to check Interval 20 mmHg -> 185 mmHg

Select **Start pump** at different combinations of the valves open/closed and push the ComWheel. The module counts the time it takes for the pressure to go up from 20 mmHg to 185 mmHg and displays it. When all the valves are closed, the pump should be able to pump the pressure in about 1 to 4 seconds into an adult cuff wrapped around a pipe. The pump does not stop without selecting **Stop Pump** by pushing the ComWheel.

4.7.7 NIBP Watchdog

These menu items have only effect on the M-NIBP modules. They do not effect other NIBP modules.

Test ADULT: is to test watchdog timer in adult mode (120 to 140 seconds).

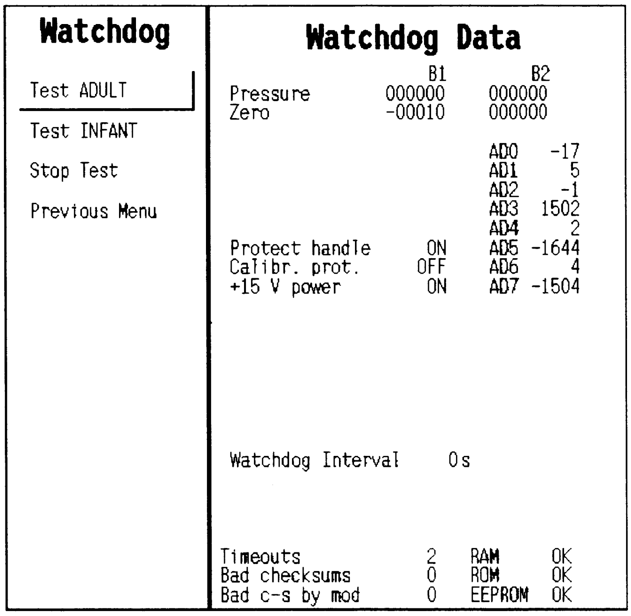
Test INFANT:is to test watchdog timer in infant mode (about 60 to 70 seconds).

Stop Test:is for stopping the test.

Watchdog Data field

For information on general items **Pressure, Zero, Protect handle, Calibr. prot., +15 V power, AD0** to **AD7** as well as **Timeouts** etc., see section "NIBP Module."

Watchdog Interval: shows the time the +15 Vdirty stays on during the test.



```
                Watchdog Data
                       B1         B2
Pressure           000000     000000
Zero               -00010     000000

                               AD0   -17
                               AD1     5
                               AD2    -1
                               AD3  1502
                               AD4     2
Protect handle         ON      AD5 -1644
Calibr. prot.         OFF      AD6     4
+15 V power            ON      AD7 -1504




Watchdog Interval     0 s



Timeouts              2     RAM     OK
Bad checksums         0     ROM     OK
Bad c-s by mod        0     EEPROM  OK
```

How to test Adult watchdog time

Select Test ADULT and press the ComWheel. Watchdog interval starts counting up seconds and keeps on counting as long as the +15 Vdirty is on. The time should be 120 to 140 seconds.

How to test Infant watchdog time

Select Test INFANT and press the ComWheel. Watchdog interval starts counting up seconds and keeps on counting as long as the +15 Vdirty is on. The time should be 60 to 70 seconds.

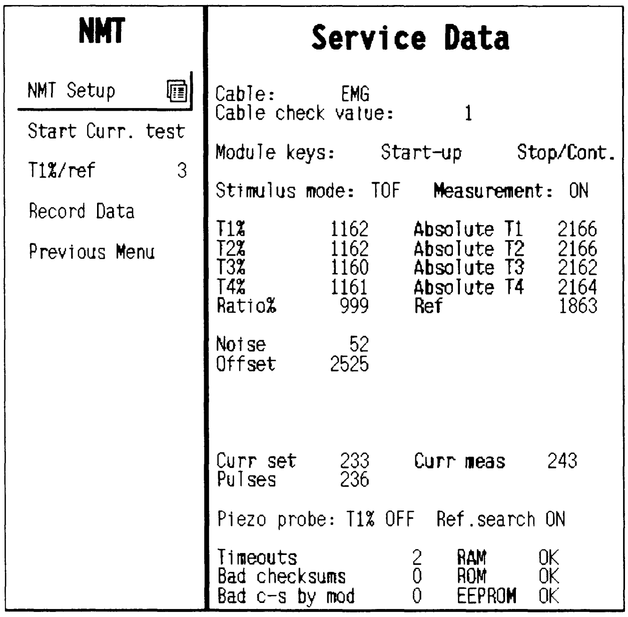
4.8 NMT

Service menu for Neuromuscular Transmission Module, E-NMT/M-NMT.

Start Curr. test is a test where the module itself checks the difference between a given current and the measured current. A 3 kΩ resistance should be connected between the stimulus electrodes before starting the test. All the currents checked will be displayed on the service data screen. After the current value, the status of the test is shown. If the test is not passed, send the module back to the factory for calibration.

T1%/ref T1% / ref gives a selection for changing settings related to the NMT MechanoSensor. A setting of **3** should always be used for normal monitoring. The settings **1** and **2** are for research purposes only.

Record Data prints out the displayed service data and circuit board information (id., serial number, and software id.) onto the recorder.



```
Cable:       EMG
Cable check value:       1

Module keys:    Start-up      Stop/Cont.

Stimulus mode:  TOF   Measurement:  ON

T1%          1162     Absolute T1    2166
T2%          1162     Absolute T2    2166
T3%          1160     Absolute T3    2162
T4%          1161     Absolute T4    2164
Ratio%        999     Ref            1863

Noise          52
Offset       2525



Curr set      233     Curr meas     243
Pulses        236

Piezo probe: T1% OFF  Ref.search ON

Timeouts               2    RAM     OK
Bad checksums          0    ROM     OK
Bad c-s by mod         0    EEPROM  OK
```

Service Data

Cable shows the type of cable being used.

Cable check value shows the bit amount. To check the value for each cable, see the following chart:

- EMG	-100...+100
- Cable OFF	>1950
- Piezo	900...1100
- Regional block	600....800

Module keys checks the function of the module keys. A blue background appears at the back of the text when a key is pressed for more than one second.

Stimulus mode shows the selected stimulus. Stimulus mode can be changed using the NMT Setup menu.

Measurement indicates ON/OFF.

T1%, T2% shows the measured response. A value of 1000 corresponds to 100%.

Absolute T1, T2 shows the voltage measured from the A/D converter.

Noise indicates the interference just before the measurement. A typical value is <100.

Offset is an average of the noise measurement. A typical value is 510.

Curr set is the selected current, a value of 700 corresponds to 70 mA.

Curr meas is the measured current, a value of 700 corresponds to 70 mA.

Pulses indicates pulses the module has produced.

Piezo probe T1% and Ref. search shows information related to the MechanoSensor settings.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Curr set is the selected current, a value of 700 corresponds to 70 mA.

Curr meas is the measured current, a value of 700 corresponds to 70 mA.

Pulses indicates pulses the module has produced.

Piezo probe T1% and Ref. search shows information related to the MechanoSensor settings.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The non-zero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum in the EPROM is in accordance with the software calculated value.
EEPROM indicates if the values stored in the permanent memory are valid.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.8.1 NMT Setup

Start-up is for starting the neuromuscular transmission measurement.

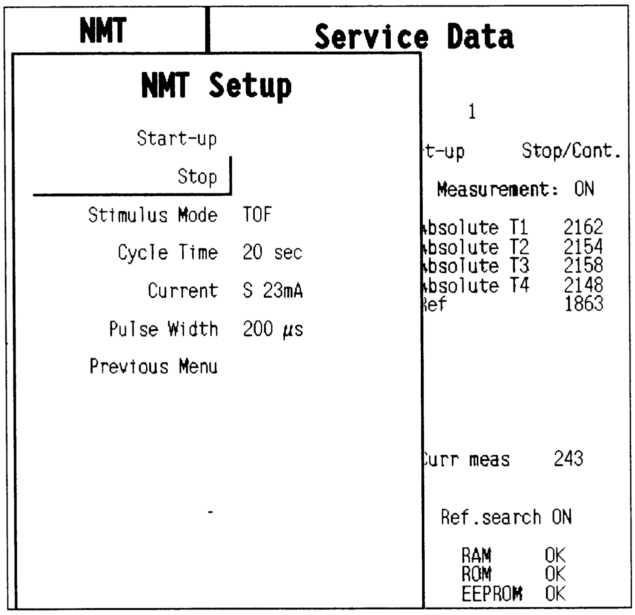
Stop is for stopping the measurement.

Stimulus Mode is for changing the stimulus mode. The choices are: **TOF** - Train of Four, **DBS** -Double Burst Stimulation or **ST** - Single Twitch mode.

Cycle Time is for changing the time interval for NMT measurement. The choices are:
for TOF and DBS: Manual and from 10 sec to 15 min.
for ST: 1, 10 and 20 sec.

Current is for changing the stimulus current strength. The current is either supramaximal (automatic start-up search) or manually selected.

Pulse Width is for selecting the desired pulse width. The choices are: 100, 200 or 300 µs.



Stimulus Mode TOF
Cycle Time 20 sec
Current S 23mA
Pulse Width 200 µs

1
t-up Stop/Cont.
Measurement: ON
bsolute T1 2162
bsolute T2 2154
bsolute T3 2158
bsolute T4 2148
ef 1863
urr meas 243
Ref.search ON
RAM OK
ROM OK
EEPROM OK

4.9 Oxygen Saturation Modules, E-NSAT, M-NSAT, M-OSAT

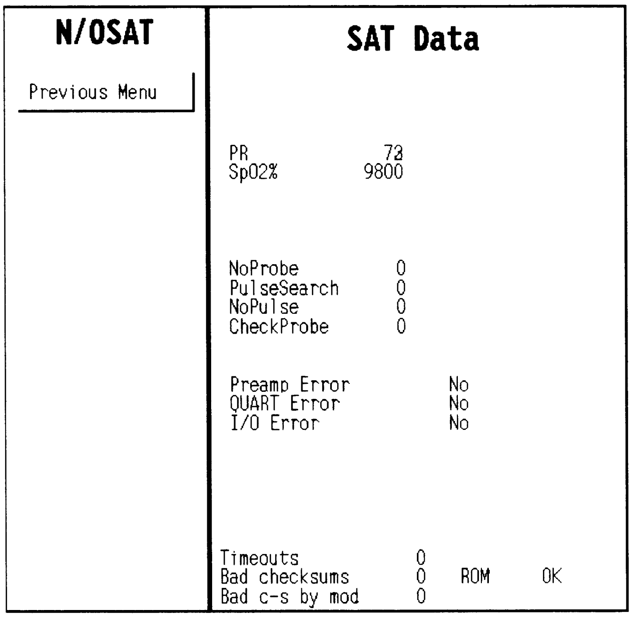
N/OSAT Data

NOTE: Preamp Error is indicated on the service menu, even though module contains MP-204 board.

NOTE: The status and error indicators are not valid for the M-OSAT and the M-NSAT..04 revision.

PR shows the pulse rate value [bpm] calculated from the pleth.
Sp0$_2$% shows the oxygen saturation value multiplied by 100.
Next are listed the **messages** that are sent from the module to the monitor. Digit '0' means that the message is not active, '1' is for the active one.
Preamp Error indicates 'Yes' if the Preamp (MP-203(4)) board detects an error.

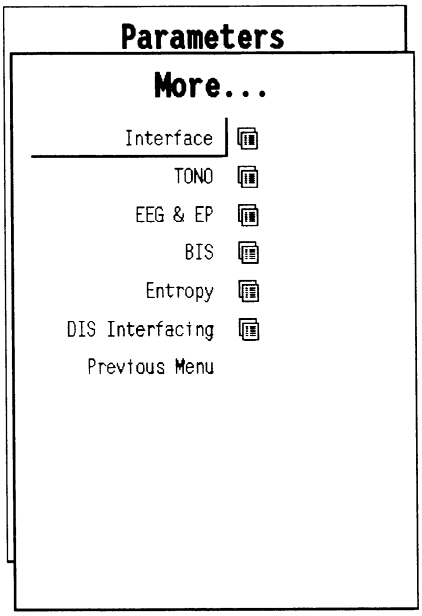
QUART Error indicates 'Yes' if an error is detected in the operation of QUART that is located in the Interface board.



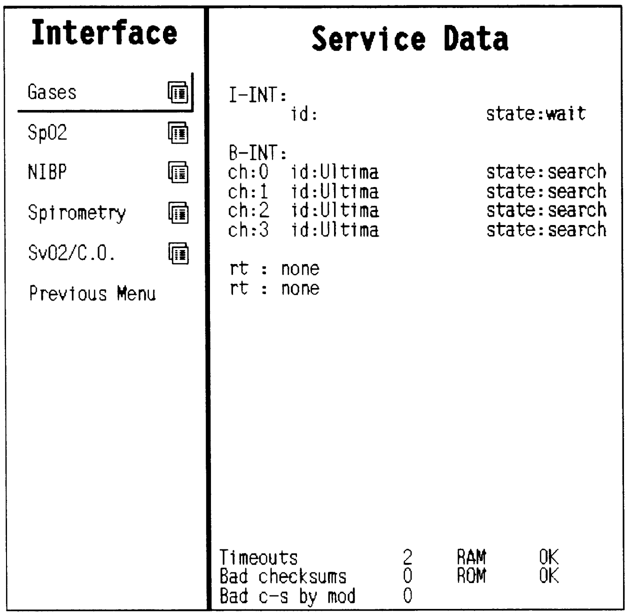
```
SAT Data

PR                73
Sp02%           9800

NoProbe            0
PulseSearch        0
NoPulse            0
CheckProbe         0

Preamp Error           No
QUART Error            No
I/O Error              No

Timeouts           0
Bad checksums      0   ROM      OK
Bad c-s by mod     0
```

I/O Error indicates 'Yes' if an error occurs in the communication between Preamp (MP-203(4)) and Interface board.
Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry. **Bad checksums** is a cumulative number that indicates how many times communication from the module to the monitor has broken down.
Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected.
The monitor starts counting these items at power up and resets to zero at power off. The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.
ROM indicates whether the checksum in the EPROM is in accordance with the one the software has calculated.
The state is either **OK, Fail** or **?** (module not in place or a communication error).

4.10 More


Parameters
More...
Interface
TONO
EEG & EP
BIS
Entropy
DIS Interfacing
Previous Menu

4.11 Interface module, E-INT, M-INT



```
I-INT:
    id:                          state:wait

B-INT:
ch:0  id:Ultima                  state:search
ch:1  id:Ultima                  state:search
ch:2  id:Ultima                  state:search
ch:3  id:Ultima                  state:search

rt : none
rt : none

Timeouts          2    RAM    OK
Bad checksums     0    ROM    OK
Bad c-s by mod    0
```

Gases, Sp0$_2$, NIBP, Spirometry, Sv0$_2$/C.O. indicate the parameters for which service data is available. The data which can be seen on those pages is raw data from the interfaced monitors, which will be processed for the normal screen.

Service Data

I-INT: Indicates the status of the interface via the UPI4(NET) Board.

B-INT: Indicates the status of the interface via the 4 interface channels of B-INT or two channels of E-INT/ M-INT module.

id: The name of the interfaced monitor, e.g. Ultima.

state: describes the state of the connection, alternatives are:
'init' - the channel is initialized
'wait' - the monitor is waiting for the external monitor
'online' - the connection is ready
'search' - the external monitor is being searched

rt: real time values that are available via the interface.

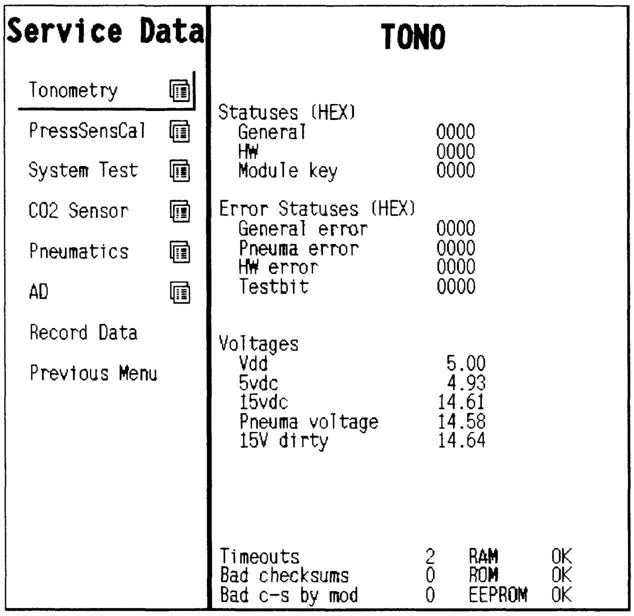
Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Bad checksums is a cumulative number that indicates how many times communication from the module to the monitor has failed.

Bad c-s by mod is a cumulative number that indicates how many communication errors the module has detected. The monitor starts counting these items at power up and resets to zero at power off. The nonzero values do not indicate a failure, but the continuous counting (more than 5 per second) indicates either a serial communication failure, or a module not in place. Also failures in other modules may cause these numbers to rise or be set to 32769.

RAM indicates the state of the RAM memory.
ROM indicates whether the checksum in the ROM is in accordance with the software calculated value.
The state is either OK, Fail or ? (module not in place or a communication error).

4.12 Tonometry



```
Statuses (HEX)
  General              0000
  HW                   0000
  Module key           0000
Error Statuses (HEX)
  General error        0000
  Pneuma error         0000
  HW error             0000
  Testbit              0000

Voltages
  Vdd                   5.00
  5vdc                  4.93
  15vdc                14.61
  Pneuma voltage       14.58
  15V dirty            14.64

Timeouts               2    RAM      OK
Bad checksums          0    ROM      OK
Bad c-s by mod         0    EEPROM   OK
```

Service menu for Gastric Tonometry Module.

Service Data

Tonometry: Another route to reach Tonometry setup menu.

PressSensCal: A selection to enter the module pressure sensor calibration menu.

System Test: A selection to enter the module system test.

CO2 Sensor: A selection to enter the module CO_2 sensor menu.

Pneumatics: A selection to enter the module pneumatics menu.

AD: A selection to enter the module AD value display.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

Statuses (HEX): See APPENDIX A How to read HEX numbers.

General: Module general status. See Table 2 Module general status for a detailed description of the message.

Table 2 Module general status

bit 0-5	Not used
bit 6	State error
bit 7	Communication failure
bit 8	Power failure
bit 9	Clock failure
bit 10	EEPROM checksum failure
bit 11	EEPROM writing failure
bit 12	ROM failure
bit 13	RAM failure
bit 14	Test mode
bit 15	Init mode

HW Module hardware status. See Table 3 Module hardware status for a detailed description of the message.

Table 3 Module hardware status

bit 0	Lamp ON
bit 1	Stepper motor ON
bit 2	Zeroing valve ON
bit 3	Pump valve ON
bit 4-15	Not used

Module key Module keyboard status. See Table 4 Module keyboard status for a detailed description of the message.

Table 4 Module keyboard status

bit 0	Button 1 (start/stop) pressed
bit 1	Button 2 (Lab.Data) pressed
bit 2-15	Not used

Error Statuses (HEX):

General error Module general error status. See Table 5 Module general error status for a detailed description of the message.

Table 5 Module general error status

Bit	Description	What to do
bit 0-1	Not used.	-
bit 2	Zeroing error. Zero gas signal out of limits or pressure or temperature signal varying during measurement.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 3	CO_2 measurement error. CO_2 signal out of limits or pressure or temperature signal varying during measurement.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 4	Measurement error. Sensor temperature, measurement pressure or absorbance is out of limits.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 5	Calibration error. Failure in calibration.	Recalibrate.
bit 6	Pneumatic error.	See pneumatic error status bits for details.
bit 7	Lamp pulsing error.	CO_2 sensor faulty. Send the module to the factory for repair.
bit 8-15	Not used.	-

Pneuma error Module pneumatics error status. See Table 6 Module pneumatics error status for a detailed description of the message.

Table 6 Module pneumatics error status

Bit	Error label	Description	What to do
0	pumping error	Stepper motor is not able to generate negative pressure at the pump pressure sensor during zeroing.	Check the function of the stepper motor.
1	eq. to amb. press failed	Before filling the catheter, the pressure in the module tubing is equilibrated to the ambient pressure by switching the pump valve on and off. If ambient pressure is not reached, this error is shown.	Calibrate the pressure sensors. Check the pump valve function.
2	tubing/zero block occl	Pressure at the pump pressure sensor gets too low, when air is aspirated though the zeroing valve.	Check tubing/valves for occlusion.
8	press sens values differ	Pump pressure and catheter pressure readings differ more than 50 mbars.	Calibrate the pressure sensors.
9	pneuma fatal error	This error is shown, if the pneumatic error occurred is considered fatal.	Check for other pneumatics errors.
10	cath press too low	Catheter pressure reading is below reasonable pressure values.	Make sure that you are not applying too low pressure to the catheter connector. Calibrate the pressure sensors.
11	cath press too high	Catheter pressure reading is above reasonable pressure values.	Make sure that you are not applying too high pressure to the catheter connector. Calibrate the pressure sensors.
12	pump press too low	Pump pressure reading is below reasonable pressure values.	Make sure that you are not applying too low pressure to the catheter connector. Calibrate the pressure sensors.
13	pump press too high	Pump pressure reading is above reasonable values.	Make sure that you are not applying too high pressure to the catheter connector. Calibrate the pressure sensors.

HW error Module hardware error status. See Table 7 Module hardware error status for a detailed description of the message.

Table 7 Module hardware error status

bit 0	Lamp error
bit 1, 2, 3	not used
bit 4	CPU EEPROM error
bit 5	Sensor EEPROM error
bit 6	Internal AD converter error
bit 7	External AD converter error
bit 8	CO_2 termopile error
bit 9	Reserved
bit 10	Temperature detector error
bit 11	Pump pressure sensor error
bit 12	Catheter pressure sensor error
bit 13	Pneumatic power failure
bit 14-15	Not used

Testbit

Testbit is a module production phase test status and is always 0000 (HEX). If the testbit status is ≠ 0000, then the module should be returned to the factory.

Voltages

Vdd; 5 V digital units driving voltage received from the module frame.

5vdc; 5 Volts of the module derived internally from 15vdc.

15vdc; 15 Volts of the module received from the module frame.

Pneuma voltage; 15 V voltage driving pneumatic elements of the module, derived from 15V dirty.

15V dirty; 15 V voltage received from the module frame.

4.12.1 Tonometry

This is another route to reach Tonometry setup menu, **Others** - ***Tonometry***. For a detailed description on how to use this menu see “User’s Reference Manual”.

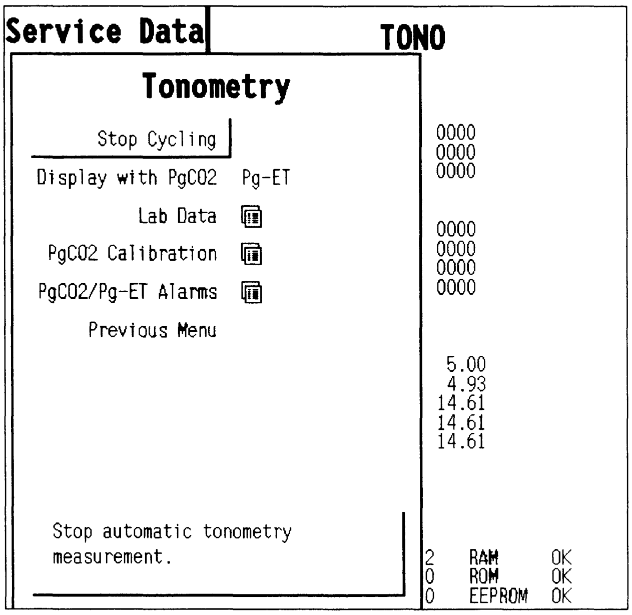
Start / Stop Cycling is for starting or stopping the measurement.

Display with PgC02 is for defining the calculated value displayed with PgC02. The choices are ***Pg-Pa, Pg-ET*** or ***pHI***.

Lab Data is for entering the blood gas values nad calculations.

PgC02 Calibration is for calibrating the tonometry.

PgC02/Pg-ET Alarms is for disabling/enabling alarms and adjusting the alarm limits.



Display with PgC02 Pg-ET

```
0000
0000
0000

0000
0000
0000
0000

 5.00
 4.93
14.61
14.61
14.61
```

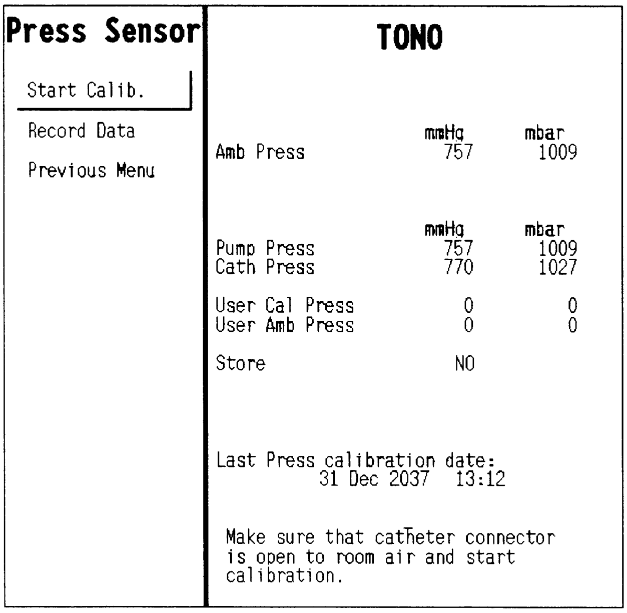
Stop automatic tonometry measurement.

```
2   RAM     OK
0   ROM     OK
0   EEPROM  OK
```

How to calibrate $PgCO_2$

1. Connect the calibration gas sampling line to the regulator and to the module’s catheter connector.
2. Select ***PgC02 Calibration***.
3. Wait until the text ‘Start feeding gas and press ComWheel. Feed gas until Adjust message is displayed’ appears. Open the regulator and start feeding gas. Press the ComWheel and continue feeding gas until the text ‘Adjust’ appears on the display.
4. Check that the displayed values match the values on the calibration gas container. Adjust with the ComWheel if necessary.
5. If airway gases are monitored, it is recommended to calibrate the airway gases at the same time.

4.12.2 Press Sensor



```
TONO

                  mmHg      mbar
Amb Press          757      1009

                  mmHg      mbar
Pump Press         757      1009
Cath Press         770      1027

User Cal Press       0         0
User Amb Press       0         0

Store               NO


Last Press calibration date:
          31 Dec 2037   13:12

 Make sure that catheter connector
 is open to room air and start
 calibration.
```

Start Calib.: A selection to start a module pressure sensor calibration sequence. The procedure is guided online.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO service data

Amb Press; ambient pressure measured by the pressure sensor. All the pressure values are given in both mmHg and mbar on this page.

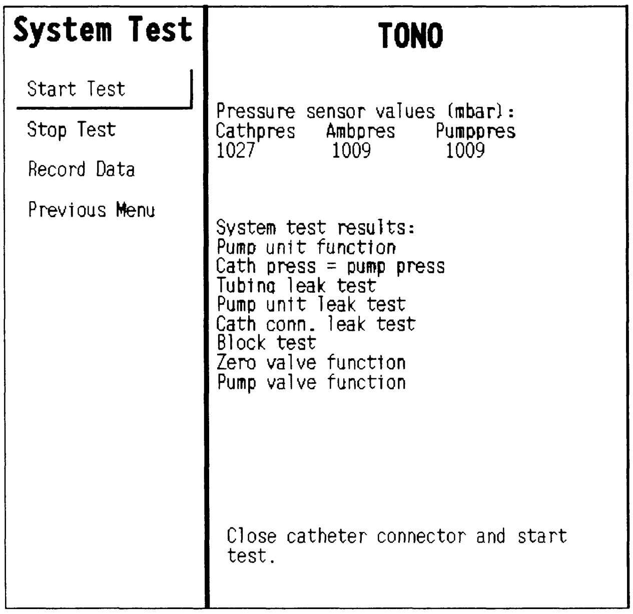
Pump Press; pressure measured from the pumping unit.
Cath Press; pressure measured from the catheter line.

User Cal Press; pressure that the user sets during the calibration sequence according to the pressure that is applied to the catheter port. The set value should be close to 100 mmHg.
User Amb Press; pressure that the user sets during the calibration sequence according to the current ambient pressure in the room.

Store; a selection for storing/discarding the newly gained calibration values.

Last Press calibration date; data read from the module that tells when the module has last been calibrated.

4.12.3 System Test



```
TONO

Pressure sensor values (mbar):
Cathpres   Ambpres    Pumppres
1027       1009       1009

System test results:
Pump unit function
Cath press = pump press
Tubing leak test
Pump unit leak test
Cath conn. leak test
Block test
Zero valve function
Pump valve function

Close catheter connector and start
test.
```

Start Test: A selection to start the automatic system test sequence. The procedure is guided online.

Stop Test: A selection to stop the automatic system test sequence.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

Cathpres; pressure measured from the catheter line [mbar].
Ambpres; ambient pressure in the room [mbar].
Pumppres; pressure measured from the pumping unit [mbar].

System test results; detailed information of the test results of different system parts. The meaning of the messages:

- "OK", the part successfully passed the test
- "FAIL", the part failed in the test
- "N/A", the test could not be carried out properly.

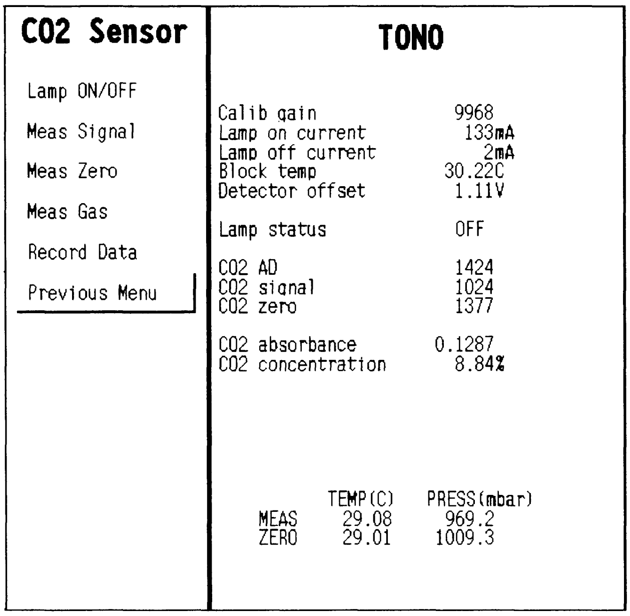
See Table 8 Description of system test for a detailed description of the tested parts.

Table 8 Description of system test

Test label	Description	If test fails
Pump unit function	Stepper motor aspirates/pushes room air through the zeroing valve. If the stepper is ~~working properly, it is able to generate small~~ negative/positive pressure at the pump unit pressure sensor.	Check the function of stepper motor.
Cath press = pump press	Pump pressure sensor and catheter pressure sensor readings are compared at three pressures: at ambient pressure, at approx. +100 mbar and -100 mbar.	Calibrate the pressure sensors.
Tubing leak test	The air tightness of the module inner tubing from the zeroing valve to the pump valve is tested.	Check tubing and connections for leaks.
Pump unit leak test	The air tightness of the pump unit is tested.	Check pump unit for leaks.

Test label	**Description**	**If test fails**
Cath conn. leak test	The air tightness of the zeroing unit and catheter connector is tested.	Make sure that the catheter connector is properly closed during the test. Check the zeroing unit and the catheter connector for leaks.
Block test	Air is aspirated through the zeroing valve. If pressure at the pump pressure sensor drops too much, the tubing/valves from the zeroing valve to the pump pressure sensor is blocked.	Check the tubing/valves for blocks.
Zero valve function	Module pneumatic system pressurized and then the zeroing valve is opened to room air. If the pressure does not drop, the zeroing valve may not be functioning.	Check the function of the zeroing valve.
Pump valve function	Module pneumatic system pressurized and then the pump valve is opened to room air. If the pressure does not drop, the pump valve may not be functioning.	Check the function of the pump valve.

4.12.4 CO_2 Sensor



```
TONO

Calib gain            9968
Lamp on current       133mA
Lamp off current        2mA
Block temp           30.22C
Detector offset       1.11V

Lamp status           OFF

CO2 AD                1424
CO2 signal            1024
CO2 zero              1377

CO2 absorbance      0.1287
CO2 concentration    8.84%


        TEMP(C)   PRESS(mbar)
MEAS     29.08      969.2
ZERO     29.01     1009.3
```

Lamp ON/OFF: A selection to toggle the sensor lamp on and off.

Meas Signal: A selection to start an automatic signal measurement sequence. This sequence measures sensor lamp signal levels.

Meas Zero: A selection to start an automatic zeroing measurement sequence.

Meas Gas: A selection to start an automatic gas measurement sequence. This sequence first performs the zeroing measurement. Then it measures the CO_2 concentration of the sample of arbitrary gas aspirated from the catheter port.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

Calib gain; CO_2 measurement gain factor that is set in calibration.
Lamp on current; sensor lamp current when lit.
Lamp off current; sensor lamp current when off.
Block temp; sensor temperature [°C] (in degrees centigrade).
Detector offset; CO_2 detector offset voltage.

Lamp status; displays whether the sensor lamp is on or off.

CO2 AD; signal from CO_2 sensor thermopile (AD counts).

CO2 signal; thermopile signal maximum - minimum when the lamp is blinking (AD counts).

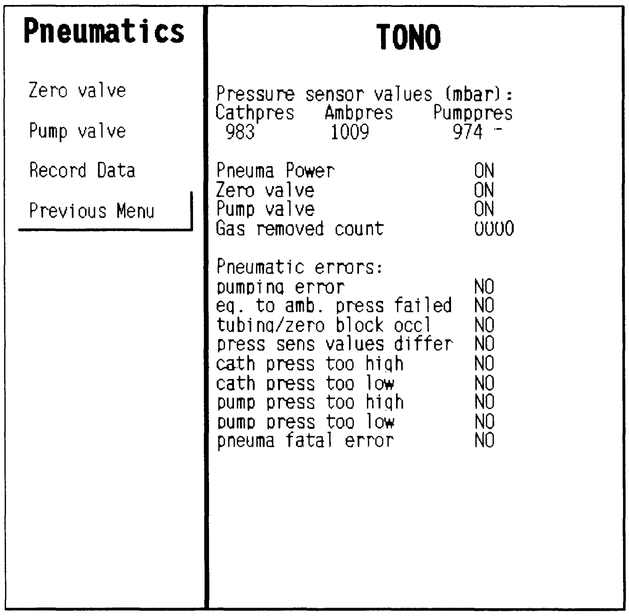
CO2 zero; thermopile signal maximum - minimum during sensor zeroing when the lamp is blinking (AD counts).

CO2 absorbance; calculated light absorbance during CO_2 measurement.

CO2 concentration; CO_2 concentration (%) in sensor (does not include compensations related to catheter measurement).

MEAS TEMP; CO_2 sensor temperature during signal measurement [°C].
MEAS PRESS; CO_2 sensor pressure during signal measurement [mbar].
ZERO TEMP; CO_2 sensor temperature during zeroing measurement [°C].
ZERO PRESS; CO_2 sensor pressure during zeroing measurement [mbar].

4.12.5 Pneumatics



```
Pressure sensor values (mbar):
Cathpres    Ambpres    Pumppres
 983         1009        974 -

Pneuma Power               ON
Zero valve                 ON
Pump valve                 ON
Gas removed count          0000

Pneumatic errors:
pumping error              NO
eq. to amb. press failed   NO
tubing/zero block occl     NO
press sens values differ   NO
cath press too high        NO
cath press too low         NO
pump press too high        NO
pump press too low         NO
pneuma fatal error         NO
```

Zero valve: A selection to toggle the zero valve on/off.

Press valve: A selection to toggle the pump valve on/off.

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

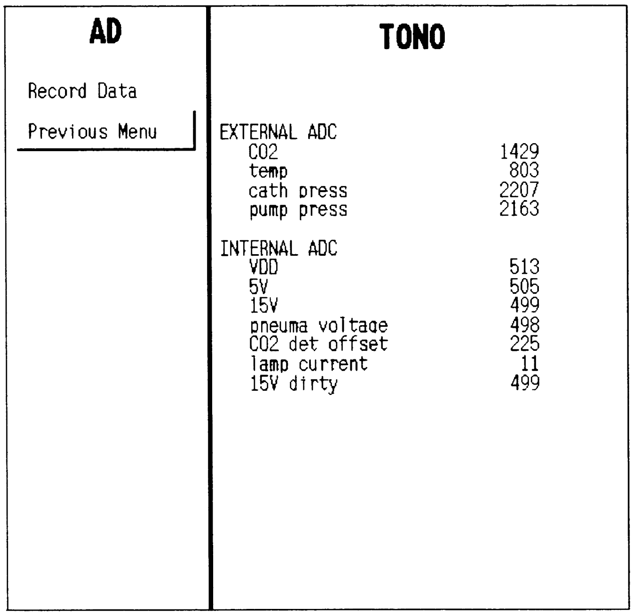
Cathpres; pressure measured from the catheter line [mbar].
Ambpres; ambient pressure in the room [mbar].
Pumppres; pressure measured from the pumping unit [mbar].

Pneuma Power; displays whether electricity has been connected to the pneumatics system or not.
Zero valve; displays whether the zero valve is on or off.
Pump valve; displays whether the pump valve is on or off.
Gas removed count; displays how many times gas is removed from the catheter during a measurement cycle.

Pneumatic errors; detailed information of the performance of different pneumatics system parts.
The meaning of the messages:
'NO', the part performed OK during the measurement = 'this error did not occur'
'YES', the part failed during the measurement = 'this error did occur'

See Table 6 Module pneumatics error status for a detailed description of the messages.

4.12.6 AD



```
TONO

EXTERNAL ADC
   CO2                        1429
   temp                        803
   cath press                 2207
   pump press                 2163

INTERNAL ADC
   VDD                         513
   5V                          505
   15V                         499
   pneuma voltage              498
   CO2 det offset              225
   lamp current                 11
   15V dirty                   499
```

Record Data: A selection to print out the shown service data to the device defined in the **...Service - Record Data** menu.

TONO

All the numbers in this section are AD counts, i.e. computer internal data.

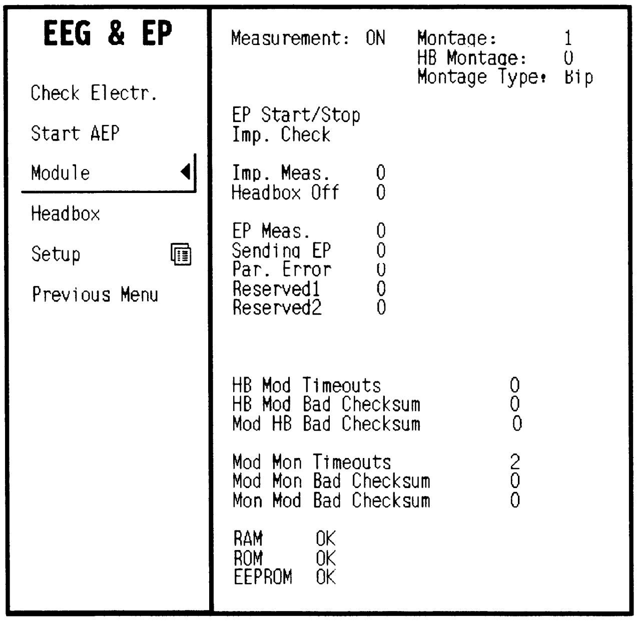
EXTERNAL ADC

CO2; CO_2 sensor CO_2 signal.
temp; CO_2 sensor temperature signal.
cath press; pressure measured from the catheter line.
pump press; pressure measured from the pumping unit.

INTERNAL ADC

VDD; 5 V digital units driving voltage received from the module frame.
5V; 5 Volts of the module derived internally from 15vdc.
15V; 15 Volts of the module received from the module frame.
pneuma voltage; 15 V voltage driving pneumatic elements of the module, derived from 15 V dirty.
CO2 det offset; CO2 detector offset voltage
lamp current; CO2 sensor lamp current
15V dirty; 15 V voltage received from the module frame

4.13 EEG & EP



```
Measurement: ON   Montage:       1
                  HB Montage:    0
                  Montage Type:  Bip

EP Start/Stop
Imp. Check

Imp. Meas.     0
Headbox Off    0

EP Meas.       0
Sending EP     0
Par. Error     0
Reserved1      0
Reserved2      0

HB Mod Timeouts              0
HB Mod Bad Checksum          0
Mod HB Bad Checksum          0

Mod Mon Timeouts             2
Mod Mon Bad Checksum         0
Mon Mod Bad Checksum         0

RAM      OK
ROM      OK
EEPROM   OK
```

Service menu for EEG Module for electroencephalography and evoked potentials (EP) measurements.

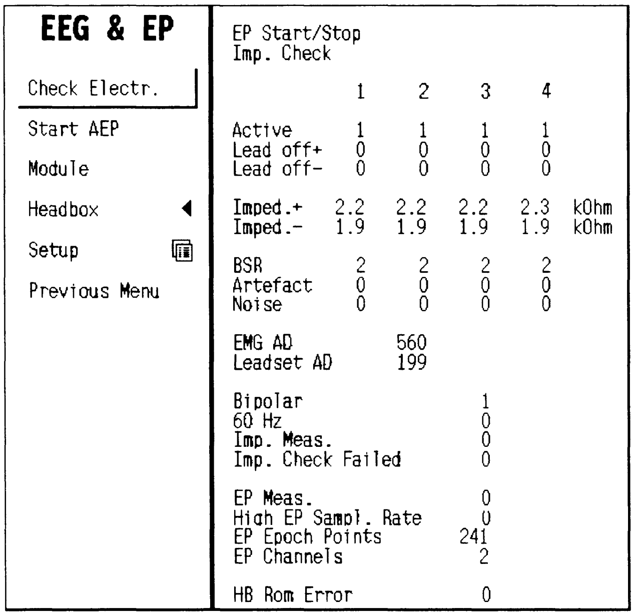
Check Electr.: Headbox measures impedance of electrodes. Works the same way as from EEG menu or the headbox/module button.
Start AEP: AEP measurement is started with current AEP settings.

Module: Service data is changed to the module view (some of the data in this view is though from headbox).
Headbox: Service data is changed to headbox view.

Service data in module view

Measurement shows whether the EEG measurement is ON or OFF. Measurement should start by itself when the leads have been on for about 15 seconds.
Montage shows the active montage in monitor.
HB Montage shows the montage attached to headbox. 0 means no montage, 1 basic, 2 general,
3 AEP, 4 Mont4 etc. up to 8, which means Mont8.
Montage Type shows whether the montage is bipolar or referenced.
EP Start/Stop is highlighted when the EP Start/Stop button is pressed in headbox or module.
Imp. Check is highlighted when the Imp. Check button is pressed in headbox or module.
Imp. Meas. shows 1 if the impedance measurement is on in the module.
Headbox Off shows 1 if the headbox cable is not connected to the module.
EP Meas. shows 1 if the evoked potential measurement is active in the module.
Sending EP shows 1 if the module has acquired 100/200 new epochs and is sending them to the monitor.
Par. Error shows 1 if the evoked potential parameters active in the module are conflicting with each other.
Reserved 1 is reserved for future use.
Reserved 2 is reserved for future use.
HB Mod Timeouts is a cumulative number that indicates how many times the headbox has not responded to the module's inquiry.
HB Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from headbox to module.
Mod HB Bad Checksum is 1 if there has been errors in the messages from the module to the headbox.
Mod Mon Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.
Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module to the monitor.
Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module.
RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).

Service data in Headbox view



```
EP Start/Stop
Imp. Check
                  1      2      3      4

Active            1      1      1      1
Lead off+         0      0      0      0
Lead off-         0      0      0      0

Imped.+         2.2    2.2    2.2    2.3   kOhm
Imped.-         1.9    1.9    1.9    1.9   kOhm

BSR               2      2      2      2
Artefact          0      0      0      0
Noise             0      0      0      0

EMG AD                 560
Leadset AD             199

Bipolar                         1
60 Hz                           0
Imp. Meas.                      0
Imp. Check Failed               0

EP Meas.                        0
High EP Sampl. Rate             0
EP Epoch Points               241
EP Channels                     2

HB Rom Error                    0
```

EP Start/Stop is highlighted when the EP Start/Stop button is pressed in the headbox or module.
Imp. Check is highlighted when the Imp. Check button is pressed in the headbox or module.

Active shows 1 if the channel is active.
Lead off+ shows the lead off status of all plus electrodes. 0 means that the lead is on and 1 that the lead is off.
Lead off- shows the lead off status of all minus electrodes. 0 means that the lead is on and 1 that the lead is off.

Imped+ shows the impedance of plus electrodes of the last impedance check in all channels.
Imped- shows the impedance of minus electrodes of the last impedance check in all channels.

BSR shows the burst-suppression classification of EEG waveforms. 0 means artifact, 1 suppression, 2 burst and 3 invalid (the EEG is not classified).
Artefact shows the artefact status of all channels. 0 means that there are no artefacts on the signal and 1 means that there are artefacts.
Noise shows 1 if the activity of FEMG is too high for clean EEG signal and that EEG is not probably reliable.

EMG AD shows the latest AD conversion result of FEMG signal without any filtering or scaling.
Leadset AD shows the latest AD conversion result of lead set signal without any scaling.

Bipolar shows the montage type that is active in the module and headbox. 1 means bipolar and 0 referenced.
60 Hz is 1 if the power frequency filter is set for 60 Hz power frequency.
Imp. Meas. shows 1 if the impedance measurement is on in the headbox.
Imp. Check Failed shows 1 if the impedance check has failed.

EP Meas. shows 1 if the evoked potential measurement is active in the headbox.
High EP Sampl. Rate shows 1 if the headbox uses higher sampling rate for 10 ms EP measurement.
EP Epoch Points shows the number of samples collected for each epoch.
EP Channels shows the number of channels used in EP measurement.
Hb ROM Error is 1 if the checksum at the EPROM is not in accordance with the one the software has calculated.

4.13.1 EEG & EP Setup

The items in the setup menu are a collection of items in normal EEG and EP menus. There are no special service settings in this menu.

Imp. Cycle: Impedance measurement repetition time.

Select Montage: Selection of headbox's electrode configuration.

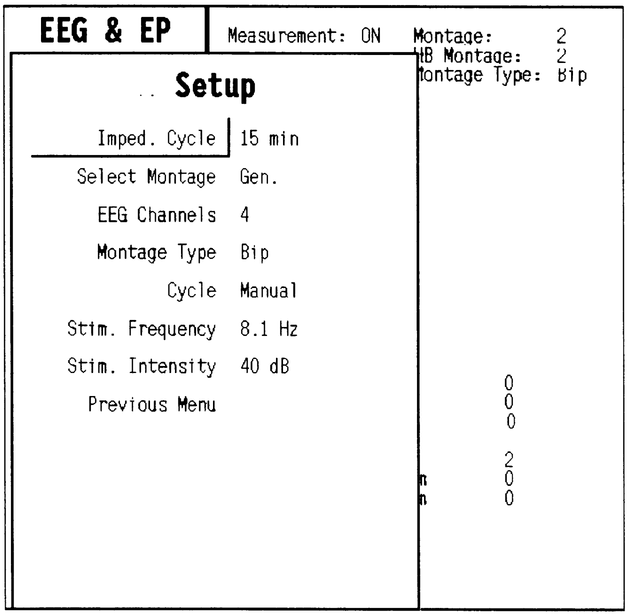
EEG Channels: Number of active channels in EEG measurement.

Montage Type: Selection of bipolar (Bip)/referenced (Ref) montage.

Cycle: EP measurement repetition time.

Stim. Frequency: EP measurement's stimulation frequency.

Stim. Intensity: Intensity of EP stimulus.

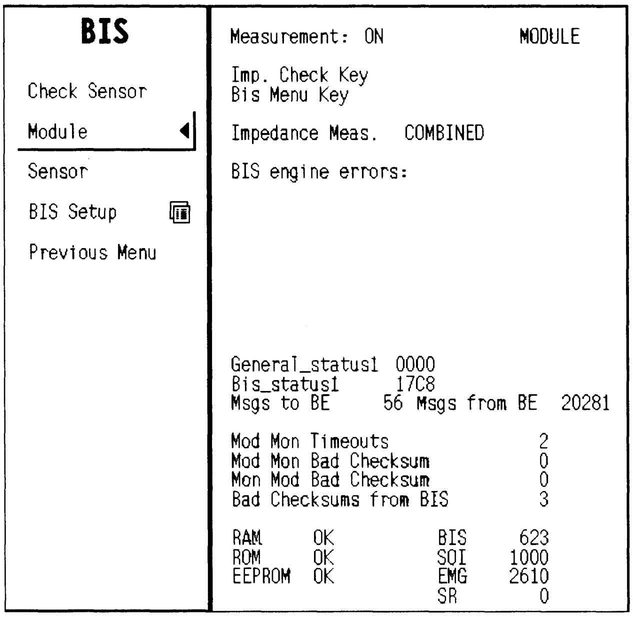


```
EEG & EP   Measurement: ON   Montage:       2
                             B Montage:     2
                             ontage Type:   Bip
        Setup

     Imped. Cycle   15 min
   Select Montage   Gen.
     EEG Channels   4
     Montage Type   Bip
            Cycle   Manual
   Stim. Frequency  8.1 Hz
   Stim. Intensity  40 dB
     Previous Menu
```

4.14 BIS

Service menu for BIS Module, M-BIS, for Bispectral index measurements.

Module service page



```
Measurement: ON              MODULE
Imp. Check Key
Bis Menu Key
Impedance Meas.  COMBINED
BIS engine errors:

General_status1  0000
Bis_status1      17C8
Msgs to BE       56 Msgs from BE   20281

Mod Mon Timeouts              2
Mod Mon Bad Checksum          0
Mon Mod Bad Checksum          0
Bad Checksums from BIS        3

RAM     OK          BIS     623
ROM     OK          SQI    1000
EEPROM  OK          EMG    2610
                    SR        0
```

Check Sensor activates the sensor impedance check.

Module

Measurement indicates if BIS Engine is on: ON/OFF.
Imp. Check Key indicates that the key in the module front panel works properly.
Bis Menu Key indicates that the key in the module front panel works properly.
Impedance Meas indicates the impedance measurement mode. The modes are CYCLIC/COMBINED/GROUND/OFF.
BIS Engine errors: error messages created by DSC or BIS Engine. For a detailed description of the error message see Table 11 BIS Engine and DSC error messages.
Statuses (HEX): See APPENDIX A How to read HEX numbers.
General Status1 indicates the general status of the module. For a detailed description of the message see Table 9 Module general status.
Bis_status1 indicates the BIS Engine status. See Table 10 BIS Engine status for a detailed description of the message.
Msgs to BE number of data packages sent from the interface board to BIS Engine.
Msgs from BE number of data packages sent from BIS Engine to the interface board.
Mod Mon Timeouts is a cumulative number that indicates how many times the module (interface board) has not responded to the monitor's inquiry.
Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module (interface board) to the monitor.
Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module (interface board).
Bad Checksums from BIS is a cumulative number that indicates how many times there has been an error in the message from the BIS Engine to the module interface board.
RAM indicates the state of the RAM memory.
ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.
EEPROM indicates if the values stored in the permanent memory are valid.
The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).
Measured parameters indicated:
BIS indicates BIS index; range 0...1000 (corresponds to 0...100)
SQI indicates signal quality index; range 0...1000 (corresponds to 0..100)
EMG indicates EMG activity level; range 0...10000 (corresponds to 0...100dB NOTE! On the display, EMG will be shown between 30...55dB on the bar graph or 30...80dB on the trend)
SR indicates supression ratio; range 0...100 (corresponds to 0...100%)

General_Status1 Module general status

Table 9 Module general status

bit 0-5	Not used
bit 6	State error
bit 7	Communication failure
bit 8	Power failure
bit 9	Clock failure
bit 10	EEPROM checksum failure
bit 11	EEPROM writing failure
bit 12	ROM failure
bit 13	RAM failure
bit 14	Test mode
bit 15	Init mode

BIS_Status1 BIS Engine status

Table 10 BIS Engine status

bit 0	Check Sensor key pressed
bit 1	BIS key pressed
bit 2	Inpedance check mode cyclic
bit 3	Impedance check mode combined
bit 4	Impedance check mode ground
bit 5	Impedance check off
bit 6	Measurement on
bit 7	EEG measurement on
bit 8	Impedance check on DSC channel 1 passed
bit 9	Impedance check on DSC channel 2 passed
bit 10	BIS Engine powerup failure
bit 11	DSC selftest failure
bit 12	DSC quick test failure
bit 13	DSC selftest on
bit 14	No data from BIS Engine
bit 15	Not used

Table 11 BIS Engine and DSC error messages

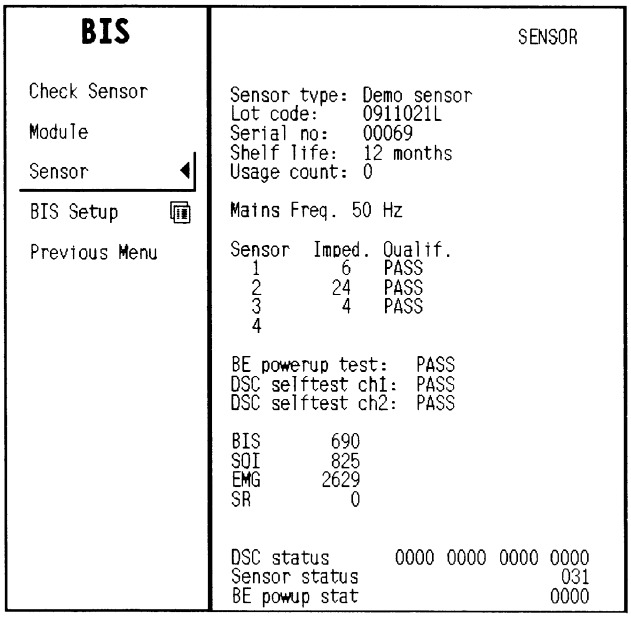
Message	Errors of type 1
DSC buffer overrun	
Out of dynamic memory	
Execution time exceeded in main	
~~Error in algorithm processing~~	
Invalid state in UART receive state machine	UART related errors
UART initalization error	
Transmit queue full	
Illegal number of data bytes for packet to be transmitted to the Host	
Illegal number of channels for EEG data	Misc. errors
Illegal EEG data type	
Illegal EEG data rate	
Illegal EEG filter coefficients	
No updates from Host	Communication related errors

Message	**Errors of type 1**
Bad CRC - TI_SELFTEST_CODE	EEPROM CRC checks
Bad CRC - TI_RUN_CODE	
Bad CRC - FPGA_CONFIG	
Bad CRC - REV_INFO	
Illegal serial number	Serial number check
DSC failed to power up	DSC related errors
Serious DSC overcurrent error	
DSC receiver data overrun	
DSC failed repeatedly in responding to commands	
DSC update failed	
Serious DSC power regulation fault	
General DSC failure	
Sensor Negative Ground Fault	Smart sensor errors
Serious Sensor Positive Ground Fault	
Serious Sensor Overcurrent Fault	

Message	**Errors of type 2**
Illegal message ID	Errors for layer 3 packets
Illegal command parameter	
Illegal length for layer 2 data	
Disabled interrupt received - UART transmitter empty interrupt	UART related errors
Disabled interrupt received - UART modem interrupt	
No status nibble received	DSC related errors
DSC not connected	
DSC disconnected after test failure	
Illegal DSC ID	
DSC power regulation fault	
DSC interface fault	
DSC did not respond to command	
Illegal PIC ID	
DSC overcurrent	

Message	**Errors of type 2**
DSC overrun	
EEPROM Bad packet length	Software update related errors
EEPROM Bad checksum	
EEPROM Bad code length	
EEPROM Illegal packet subtype	
EEPROM physical write error	
EEPROM NOT_DATA_TIMEOUT	

4.14.1 Sensor



```
Sensor tvpe:  Demo sensor
Lot code:     0911021L
Serial no:    00069
Shelf life:   12 months
Usage count:  0

Mains Freq.  50 Hz

Sensor  Imped. Qualif.
  1        6   PASS
  2       24   PASS
  3        4   PASS
  4

BE powerup test:   PASS
DSC selftest ch1:  PASS
DSC selftest ch2:  PASS

BIS        690
SOI        825
EMG       2629
SR           0

DSC status        0000 0000 0000 0000
Sensor status                     031
BE powup stat                    0000
```

Sensor type: indicates the type of the sensor connected.
Lot code: indicates the manufacturing lot code of the sensor. The lot code contains the manufacturing date and shift.
Serial no: indicates the serial number of the sensor.
Shelf life: indicates max storage duration.
Usage count: indicates how many times the sensor has been attached/detached. Not in use.
Mains Freq.: indicates the set mains frequency; 50Hz/60 Hz.
Sensor Impedances: indicates the last measured impedances.
Imped. indicates the measured impedance value in Kohms.
Qualif. indicates the quality of the measured impedance; PASS/FAIL.
BE powerup test: indicates the status of BIS Engine power up test: PASS/FAIL.
DSC selftest ch1: indicates the DSC selftest status for channel 1: PASS/FAIL.
DSC selftest ch2: indicates the DSC selftest status for channel 2: PASS/FAIL.
Measured parameters indicated:
BIS indicates BIS index; range 0..1000 (corresponds to 0..100)
SQI indicates signal quality index; range 0..1000 (corresponds to 0..100)
EMG indicates EMG activity level; range 0..10000 (corresponds to 0..100dB) (NOTE! On the trend display, EMG will be shown between 30..80dB)
SR indicates supression ratio; range 0...100 (corresponds to 0..100%)
Statuses (HEX): See APPENDIX A How to read HEX numbers.
DSC status: indicates the DSC status for the four channels. See Table 12 DSC status for a detailed description of the message.
Sensor status: indicates the Sensor status. See Table 13 Sensor status for a detailed description of the message.
BE powup stat: indicates the BE power up status. See Table 14 BE power up status for a detailed description of the message.

Table 12 DSC status

bit 0	Noise test
bit 1	BIS key pressed
bit 2	Blocked droop test
bit 3	Unblocked gain test
bit 4	Impedance wait time out test
bit 5	Noise timeout test
bit 6	Blocked timeout test
bit 7	Unblocked timeout test
bit 8	DSC not connected test
bit 9	Not used test
bit 10	Not used test
bits 11 - 15	Not used

Table 13 Sensor status

bit 0	Quick selftest pass
bit 1	Quick selftest gain
bit 2	Quick selftest noise
bit 3	Quick selftest fail
bit 4	Quick selftest valid
bit 5	Sensor valid
bit 6	Sensor invalid
bit 7	Sensor too many uses
bit 8	Sensor expired
bit 9	Sensor validity unknown
bits 10 -15	Not used

Table 14 BE power up status

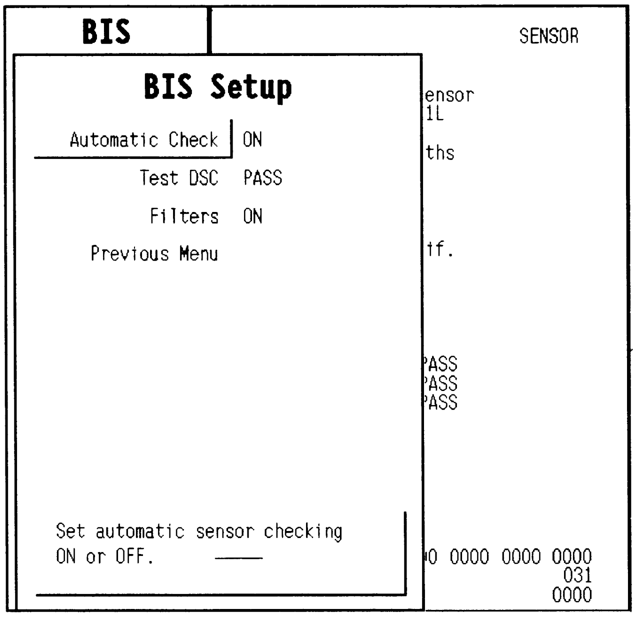
bit 0	XRAM test
bit 1	Dma test
bit 2	Timer test
bit 3	Fpga test
bits 4 -15	Not used

4.14.2 BIS Setup

Automatic Check: A selection to define whether the automatic sensor check is used ON/OFF.

Test DSC indicates the status of the DSC self test; PASS/FAIL.

Filters: A selection to define if filters are used
ON; disturbances are filtered from the raw EEG signal
OFF; raw EEG signal is shown.



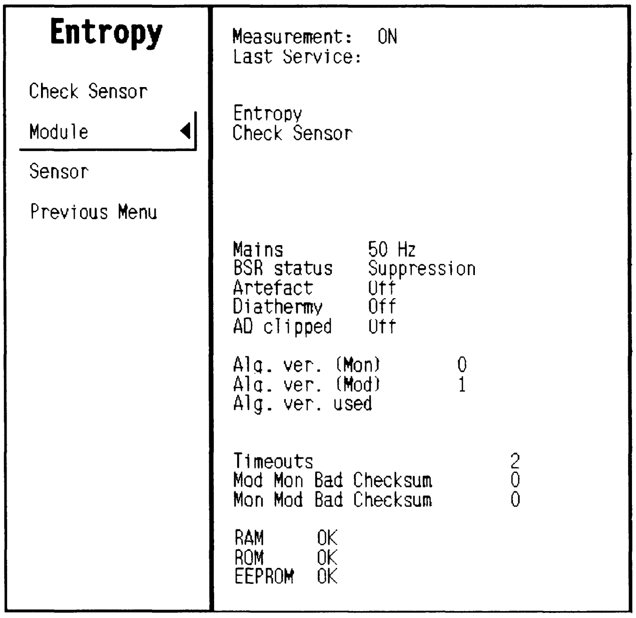
BIS Setup

Automatic Check ON
Test DSC PASS
Filters ON
Previous Menu

Set automatic sensor checking ON or OFF.

BIS
SENSOR
ensor
1L
ths
if.
ASS
ASS
ASS
0 0000 0000 0000
031
0000

4.15 Entropy



```
Measurement:  ON
Last Service:

Entropy
Check Sensor

Mains         50 Hz
BSR status    Suppression
Artefact      Off
Diathermy     Off
AD clipped    Off

Alg. ver. (Mon)        0
Alg. ver. (Mod)        1
Alg. ver. used

Timeouts                    2
Mod Mon Bad Checksum        0
Mon Mod Bad Checksum        0

RAM     OK
ROM     OK
EEPROM  OK
```

Check Sensor Module measures the impedance of sensor electrodes. Works the same way as from Entropy menu or module key.

Module Service data is changed to the module view.

Measurement shows whether the Entropy measurement is ON or OFF. Measurement should start by itself when the sensor is attached to the patient.

Last service shows the date of last maintenance.

Entropy refers to the respective module key. Is highlighted when the Entropy key is pressed on the module. (Opens the Entropy menu.)

Check Sensor is highlighted when the Check Sensor key is pressed on the module. Activates the sensor check.

Mains shows the currently used mains frequency, 50 or 60 Hz:

BSR Status shows Burst if the module is not currently detecting suppressed EEG. Shows Suppression if the module is detecting suppressed EEG periods.

Artefact shows Off, if there is no high-frequency noise present, On if the module detects noise.

Diathermy shows On, if the module is detecting diathermy (i.e., electrocautery).

AD clipped shows On, if the signal is getting clipped at the A/D converter.

Alg. ver. (Mon) shows the monitor algorithm version number.

Alg. ver. (Mod) shows the module algorithm version number.

Alg. ver. used shows the currently used algorithm version.

Timeouts is a cumulative number that indicates how many times the module has not responded to the monitor's inquiry.

Mod Mon Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the module to the monitor.

Mon Mod Bad Checksum is a cumulative number that indicates how many times there has been an error in the message from the monitor to the module.

RAM indicates the state of the RAM memory.

ROM indicates whether the checksum at the EPROM is in accordance with the one the software has calculated.

EEPROM indicates if the values stored in the permanent memory are valid. The states in memory checks are **OK, Fail** or **?** (module not in place or a communication error).

4.15.1 Sensor

Sensor Service data is changed to the sensor view.

Entropy refers to the respective module key. Is highlighted when the Entropy key is pressed on the module. (Opens the Entropy menu.)

Check Sensor is highlighted when the Check Sensor key is pressed on the module. Activates the sensor check.

Cable indicates whether the Entropy sensor cable is connected to the module or not.

Sensor indicates whether the Entropy sensor is connected to the cable or not.

Sensor S/N module reads the manufacturing serial number from the sensor chip.

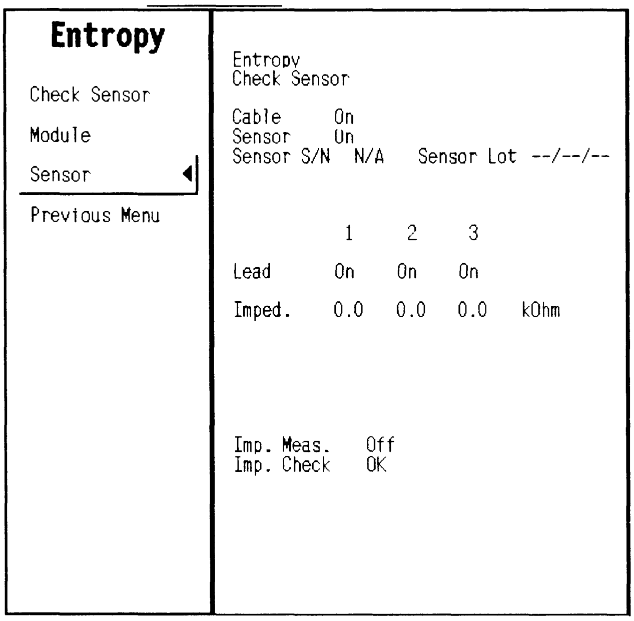
Sensor Lot module reads the manufacturing lot number from the sensor chip.

Lead 1/2/3 shows the lead on/off status of all sensor electrodes.

Imped. 1/2/3 shows the respective impedance value of each sensor electrode of the last impedance check.

Imp. Meas. shows On if the Automatic check (sensor impedance measurement) is on in the module.

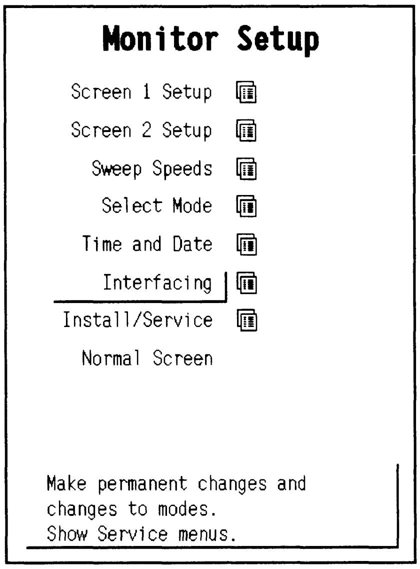
Imp. Check shows OK if the last impedance check has been successful.



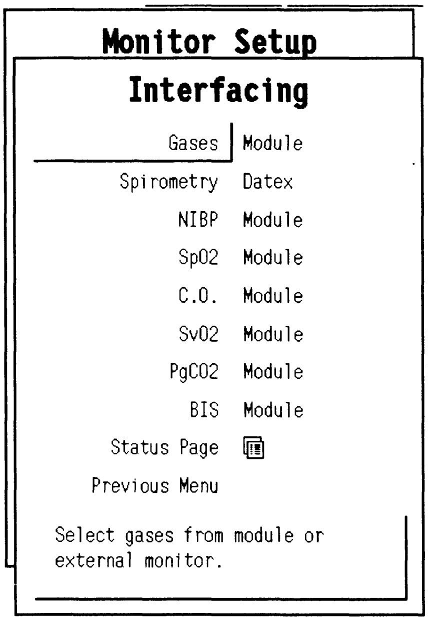
```
Entropy
Check Sensor

Cable      On
Sensor     On
Sensor S/N  N/A    Sensor Lot  --/--/--


              1      2      3

Lead         On     On     On

Imped.       0.0    0.0    0.0    kOhm



Imp. Meas.    Off
Imp. Check    OK
```

4.16 DIS Interfacing

4.16.1 Interfacing


Monitor Setup
Screen 1 Setup
Screen 2 Setup
Sweep Speeds
Select Mode
Time and Date
Interfacing
Install/Service
Normal Screen

Make permanent changes and changes to modes.
Show Service menus.


Monitor Setup
Interfacing
Status Page
Previous Menu

Gases Module
Spirometry Datex
NIBP Module
SpO2 Module
C.O. Module
SvO2 Module
PgCO2 Module
BIS Module

Select gases from module or external monitor.

How to interface

To select the parameter data source:

- Press the **Monitor Setup** and select ***Interfacing***.
- Select the desired measurement parameter, for example ***Gases***.
- Select the desired source by name, for example ***Aest***.

NOTE: The name of the device is visible on the list only if the device is correctly connected to the module.

4.16.2 Status Page

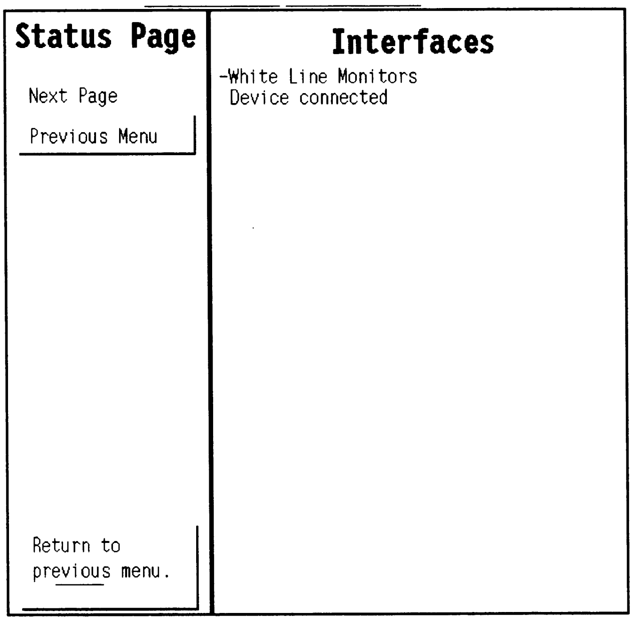
Access via **Monitor setup** - ***Interfacing.***

The selection **Next page** is available, if more than 8 DIS modules are connected to the DIS bus simultaneously.

Interfaces

The menu displays a list of all connected DIS modules and the statuses of the corresponding external devices.

If the bus voltage is too low, you cannot add more devices. 'DIS module bus voltage low. Do not add more devices or reduce cable length' message appears.

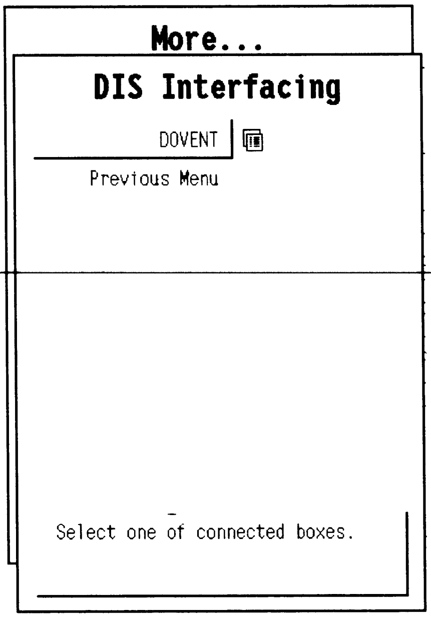

Status Page
Next Page
Previous Menu
Return to previous menu.
Interfaces

-White Line Monitors
Device connected

4.16.3 DIS Interfacing service menu

Access via **Monitor setup** - ***Install/Service -Service.***

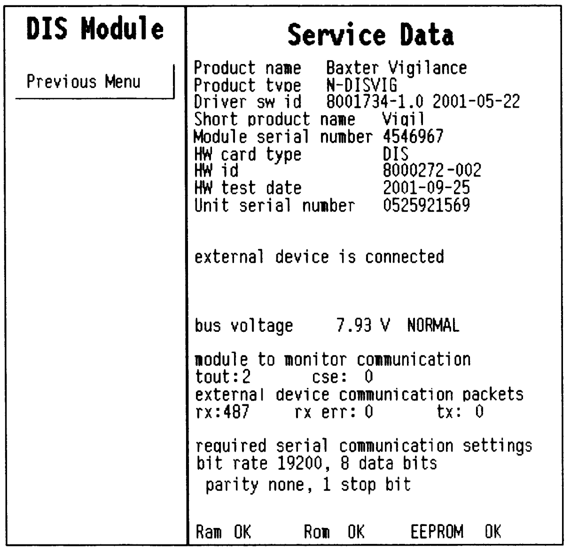
The menu displays submenus for all connected DIS modules.


More...
DIS Interfacing
DOVENT
Previous Menu

Select one of connected boxes.

DIS Module specific page

Service Data



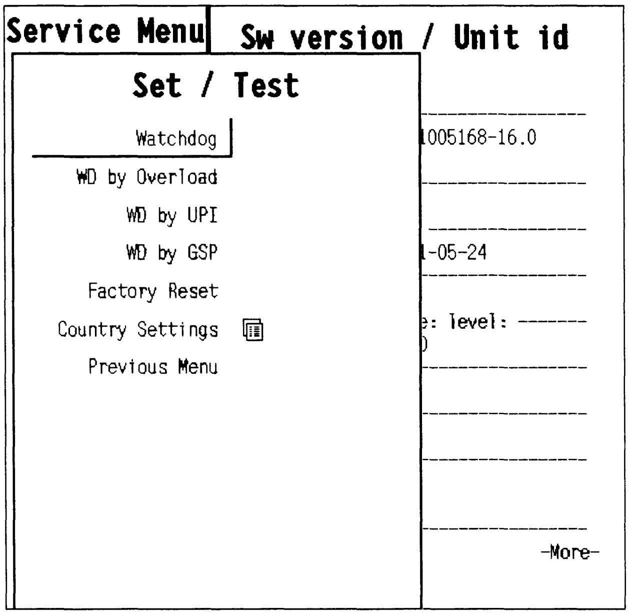
```
Product name   Baxter Vigilance
Product type   N-DISVIG
Driver sw id   8001734-1.0 2001-05-22
Short product name   Vigil
Module serial number 4546967
HW card type         DIS
HW id                8000272-002
HW test date         2001-09-25
Unit serial number   0525921569


external device is connected



bus voltage     7.93 V  NORMAL

module to monitor communication
tout:2      cse:  0
external device communication packets
rx:487     rx err: 0       tx:  0

required serial communication settings
bit rate 19200, 8 data bits
 parity none, 1 stop bit


Ram  OK      Rom  OK      EEPROM   OK
```

Product name: DIS module name.
Product type: DIS module type.
Driver sw id: DIS module software and its release date.
Short product name: DIS module name.
Module serial number: DIS module serial number.
HW card type: PCB type.
HW id: DIS module PCB identification number.
HW test date: DIS module PCB testing date.
Unit serial number: DIS module PCB serial number.

Comment field: Indicates the status of the external device.

bus voltage: DIS bus voltage, measured by the UPI4(NET) board or the Central Processing Board in S/5 Compact Monitor. The value should normally be within 6...8 V.
tout: DIS module timeouts, seen by the monitor. The value should not increase more than by 5 per second.
cse: DIS module checksum errors, seen by the monitor. The value should not increase more than by 5 per second.
rx: The number of data packets from the external device received by the DIS module.
rx err: The number of data errors from the external device received by the DIS module.
tx: The number of data packets to the external device sent by the DIS module.
Ram: Status of DIS module RAM memory.
Rom: Status of DIS module ROM memory.
EEPROM: Status of DIS module EEPROM memory.

5 Set/Test



The power supply unit contains a watchdog circuitry, which needs refreshment at every 1.5 seconds. If the refreshment did not occur, the watchdog circuitry will reset the main CPU. In normal operation, the main CPU refreshes the watchdog circuitry at every 0.2 seconds.

The purpose of the watchdog circuitry is to restart the monitor, if there was a serious malfunction. This feature is useful in two cases: when the main CPU is not able to control the monitor, or when the CPU controls the monitor but detects a serious malfunction. Watchdog tests check the proper functionality of the watchdog circuitry in various conditions.

Watchdog test ensures directly that the watchdog of the power unit functions properly. Choosing this test prevents the watchdog circuitry from refreshing and shows running seconds with an accuracy of 0.1 seconds.

The test should have the following result when the watchdog circuitry is working properly: The monitor will restart after 1.5 seconds from the start of the test. In malfunction: '>20 s' is displayed, and the test will be interrupted. In this case, the fault is in the watchdog circuitry of the power unit.

WD by Overload test ensures the functionality of a feature, where the software controls the monitor, but detects an overload situation in the main CPU.

The test should have the following result when the feature is working properly: The monitor will restart after 15 seconds from the start of the test.

WD by UPI test ensures the functionality of a feature, where the software controls the monitor, but detects a malfunction in the UPI processor and restarts the UPI4(NET) board. The test will prevent the UPI processor from functioning during the test.

The test should have the following result when the feature is working properly: The monitor will restart the UPI4(NET) board without any visual effects.

WD by GSP ensures the functionality of a feature, where the software controls the monitor, but detects a malfunction in GSP processor (located on the primary display controller board) and performs a restart. The test will prevent GSP processor from functioning during the test.

Immediately after the test starts, the screen update stops. The test should have the following result when the feature is working properly: The monitor will restart after 5 seconds from the start of the test.

Factory Reset restore factory default settings and clear data memories. Factory reset should be run if monitor software is replaced or if the SRAM/Timekeeper battery is replaced.

5.1 Country Settings

Language

Select the software language.

National Reqs

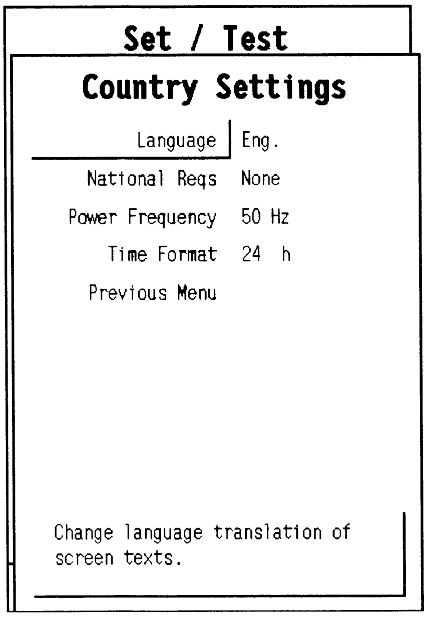
Select the software features, which include national requirements.

Power Frequency

Set the power frequency (50 Hz/60 Hz). This setting is used to filter out possible power frequency interference from the parameter measurements.

Time format

Set time format of the real time clock (24 h/12 h).



Language Eng.

National Reqs None

Power Frequency 50 Hz

Time Format 24 h

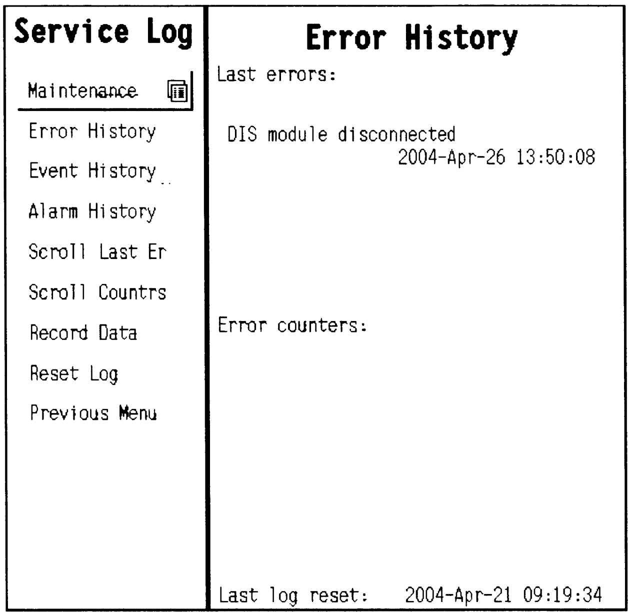
Change language translation of screen texts.

6 Service Log

Error, event, alarm and maintenance data is stored in Service Log.
The service log contains information about the occurred monitor errors, events and alarms since the last factory reset or service log reset. The service log is saved in the EEPROM memory of the main CPU board. The user can also store different maintenance events to the maintenance log.

Maintenance menu is for setting and viewing the maintenance information of the monitor.

Error History is for selecting the error history view onto the right side of the menu.
Event History is for selecting the event history view onto the right side of the menu.
Alarm History is for selecting the alarm history view onto the right side of the menu.
Scroll Last Er (Ev) is for scrolling the error / event / alarm information on the right side of the menu.
Scroll Counters is for scrolling the error / event / alarm counters on the right side of the menu.
Record Data is for recording the service log information onto the recorder.
Reset Log is for clearing up the content of the service log. This function should be run after a performed maintenance. In Error/Event history view, the Reset Log command clears up both the error and the event log. In the Alarm History view, the Reset Log command resets only the alarm history log.



```
Last errors:

 DIS module disconnected
                     2004-Apr-26 13:50:08

Error counters:

Last log reset:   2004-Apr-21 09:19:34
```

6.1 Maintenance

The Maintenance History Log gives the user a possibility to store the maintenance history of the monitor. The user can store different planned maintenance (PM) events, repairs and upgrades to the maintenance history log.

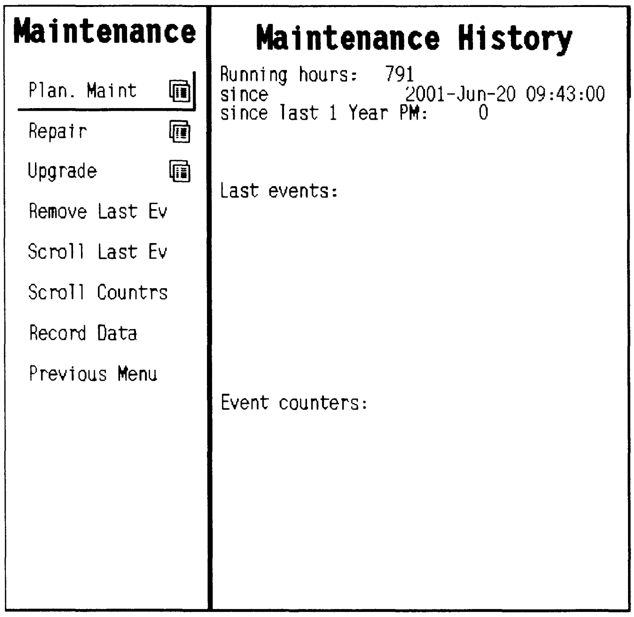
Running hours: shows how many hours the monitor has been on. User cannot reset this value.

since This date and time is set at the factory and it shows the manufacturing date and time. User cannot reset this date and time.

since last 1 year PM: shows the running hours since the last 1 year PM storing.

Last events: The section shows the last maintenance events and the time of their occurrence.

Event counters: The section contains counters for each different maintenance events. The time of occurrence of the last event is shown beside each counter.


Maintenance
Plan. Maint
Repair
Upgrade
Remove Last Ev
Scroll Last Ev
Scroll Countrs
Record Data
Previous Menu
Maintenance History

Running hours: 791
since 2001-Jun-20 09:43:00
since last 1 Year PM: 0

Last events:

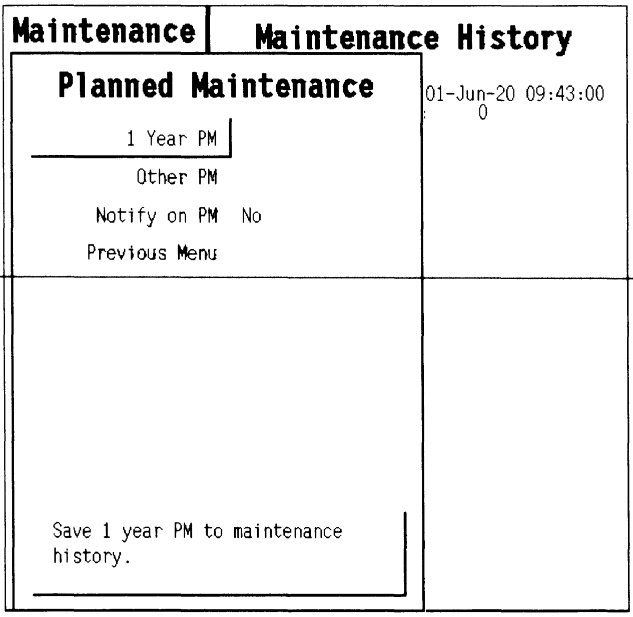
Event counters:

6.1.1 Planned Maintenance

1 Year PM gives you the possibility to store a 1 year PM event to the maintenance history log.

Other PM gives you the possibility to store another PM event to the maintenance history log.

Notify on PM This feature is for future purposes.


Maintenance
Maintenance History
Planned Maintenance
1 Year PM
Other PM
Previous Menu

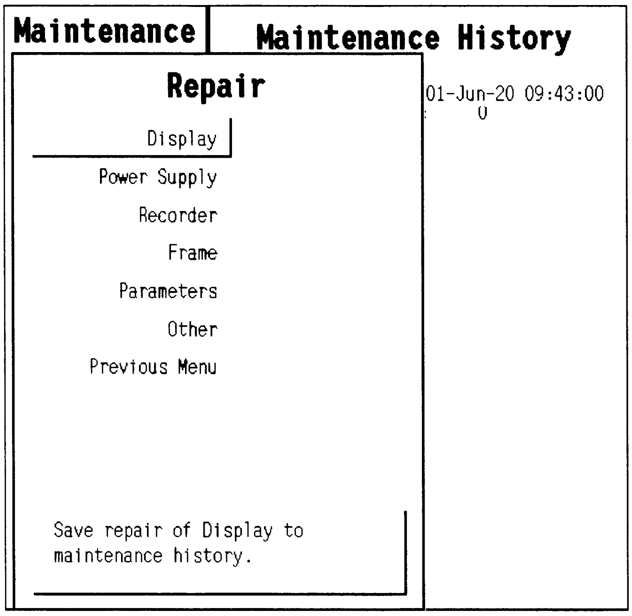
Notify on PM No

01-Jun-20 09:43:00
0

Save 1 year PM to maintenance history.

6.1.2 Repair

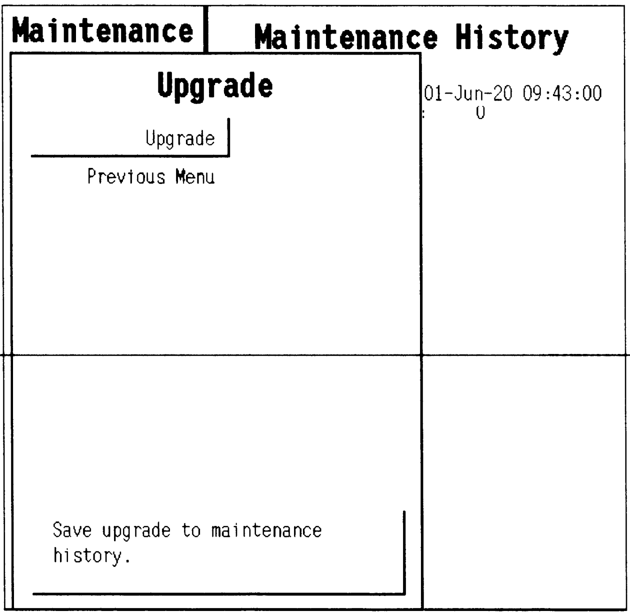
The repair menu gives the user a possibility to store repair events to the maintenance history log. The different repairs that can be saved are: **Display, Power Supply, Recorder, Frame** (e.g. board in the frame), **Parameters** (e.g. a board in the parameter module) or **Other** (a miscellaneous repair not specified by previous options).


Maintenance
Maintenance History
Repair
01-Jun-20 09:43:00
:
0
Display
Power Supply
Recorder
Frame
Parameters
Other
Previous Menu

Save repair of Display to maintenance history.

6.1.3 Upgrade

The upgrade menu gives the user a possibility to store the upgrades to the maintenance history log.


Maintenance
Maintenance History
Upgrade
01-Jun-20 09:43:00
:
0
Upgrade
Previous Menu

Save upgrade to maintenance history.

6.2 Error History

Last Errors: The section shows the last monitor errors and the time of their occurence.

Error counters: The section contains counters for each different (detected) monitor errors. The time of occurrence of the last error is shown beside each counter.

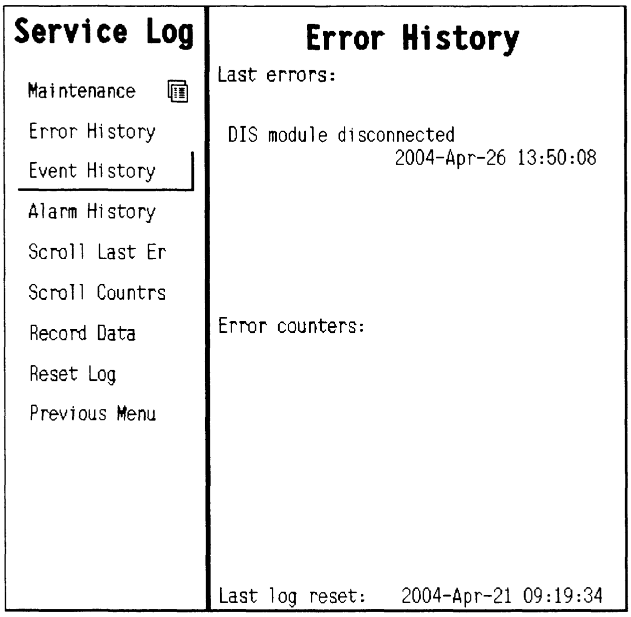
Last log reset: The date and time of the last Error/Event log reset.

Possible errors:

Fast cold start indicates the number of erroneous cold starts with power off time less than 20 seconds. The reason can be either a failing lead acid battery or a software problem that was solved by the hardware watchdog circuitry located in the monitor's power supply unit.

GSP watch-dog timeout indicates an erroneous restart controlled by the main CPU board and caused by the display controller board. The restart is listed as a fast cold start.

UPI watch-dog timeout indicates an erroneous restart controlled by the main CPU board and caused by the UPI or UPINET board. The restart is listed as a fast cold start.


Service Log
Maintenance
Error History
Event History
Alarm History
Scroll Last Er
Scroll Countrs
Record Data
Reset Log
Previous Menu

```
Error History
Last errors:

 DIS module disconnected
                      2004-Apr-26 13:50:08

Error counters:

Last log reset:   2004-Apr-21 09:19:34
```

6.3 Event History

Last events: The section shows the last events and the time of their occurrence.

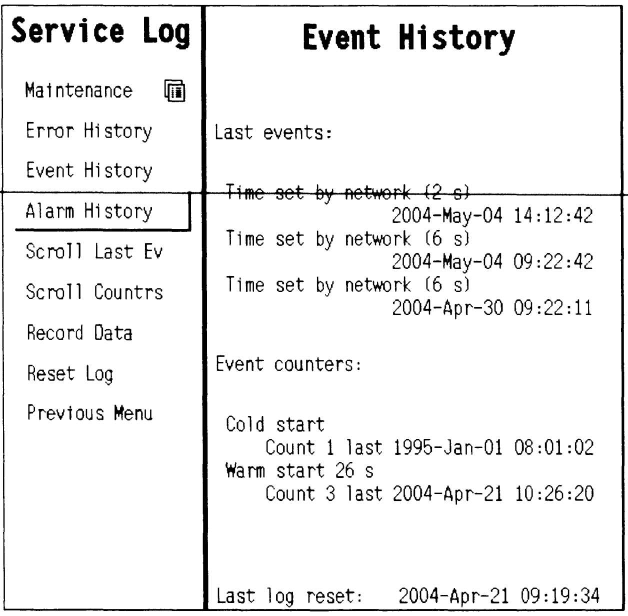
Event counters: The section contains counters for each different (detected) events. The time of occurrence of the last event is shown beside each counter.

Last log reset: The date and time of the last Error/Event log reset.

Possible events:

Cold start is a start-up with power off time more than 15 minutes. The trend memory is cleared and monitoring starts with the user default settings.

Warm start is a start-up with power off time less than 15 minutes. The trend information and possible temporary settings are still available.


Service Log
Maintenance
Error History
Event History
Alarm History
Scroll Last Ev
Scroll Countrs
Record Data
Reset Log
Previous Menu

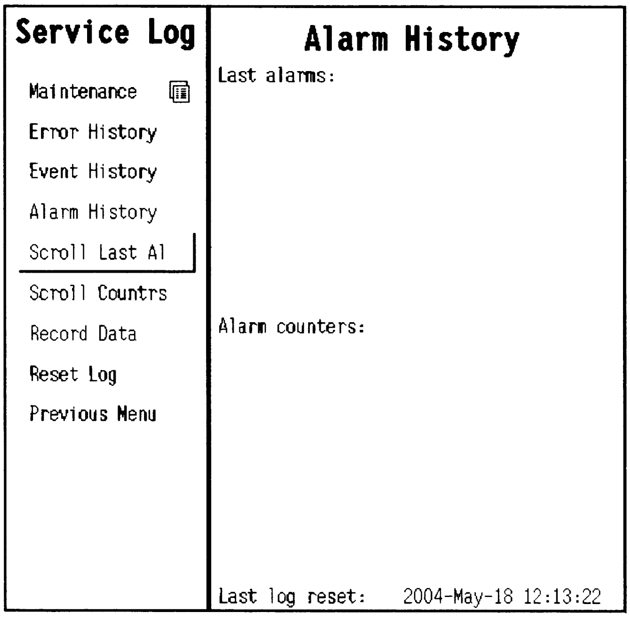
```
Event History

Last events:

 Time set by network (2 s)
                      2004-May-04 14:12:42
 Time set by network (6 s)
                      2004-May-04 09:22:42
 Time set by network (6 s)
                      2004-Apr-30 09:22:11

Event counters:

 Cold start
    Count 1 last 1995-Jan-01 08:01:02
 Warm start 26 s
    Count 3 last 2004-Apr-21 10:26:20

Last log reset:   2004-Apr-21 09:19:34
```

6.4 Alarm History

Last alarms: The section shows the last events and the time of their occurrence.

Alarm counters: The section contains counters for each different (detected) events. The time of occurrence of the last event is shown beside each counter.

Last log reset: The date and time of the last alarm log reset.


Service Log
Maintenance
Error History
Event History
Alarm History
Scroll Last Al
Scroll Countrs
Record Data
Reset Log
Previous Menu
Alarm History

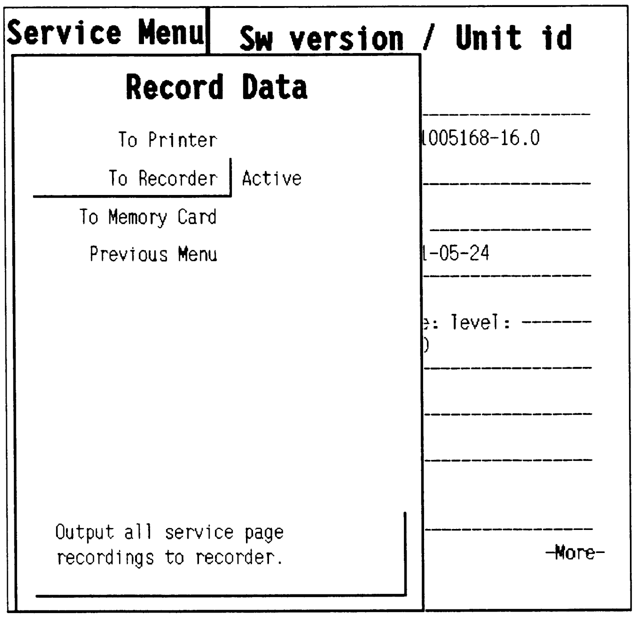
Last alarms:

Alarm counters:

Last log reset: 2004-May-18 12:13:22

7 Record Data

In this menu, the user can specify where to print from any service menu. The setting goes into the permanent memory of the monitor. Only one option can be chosen at a time. The options where to print are: **To Printer, To Recorder** and **To Memory Card**. Only the option **To Recorder** can be selected currently. When any of the front panel keys of the recorder module, E-REC/M-REC is pressed, the output is the recorder module despite of the setting of Record Data menu.


Service Menu
Sw version / Unit id
Record Data
To Printer
To Memory Card
Previous Menu
005168-16.0
-05-24
: level: -------
-More-

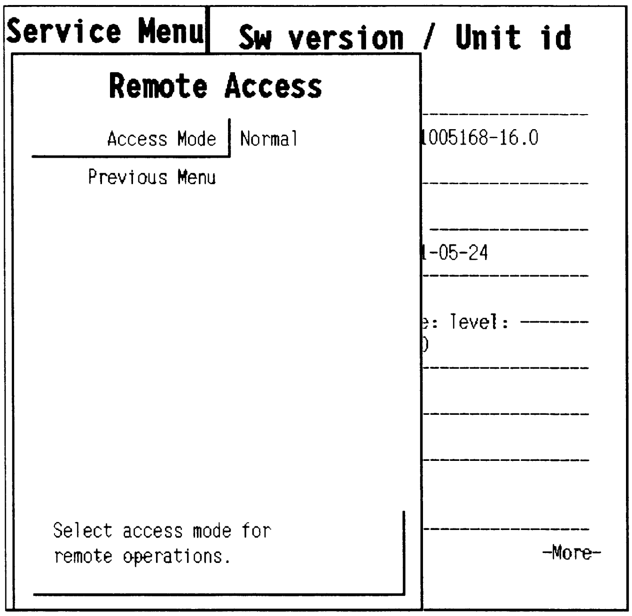
To Recorder Active

Output all service page recordings to recorder.

8 Remote Access

Remote Access menu is for setting the interface with an external PC that runs the Virtual Support software, which is a service diagnostic tool for remote diagnostics purposes.
When the access mode is set to **Normal** (the default), the PC can only read service menu data from the monitor. With the access mode **Extended,** the PC can also activate the monitor's service menu functions.

NOTE: Patient monitoring is not possible, when the access mode Extended is selected. The access mode turns back to Normal, if the monitor is restarted or if the service menu is closed.


Service Menu
Sw version / Unit id
Remote Access
Previous Menu
005168-16.0
-05-24
: level:
-More-

Access Mode Normal

Select access mode for remote operations.

APPENDIX A How to read HEX numbers

Some statuses on BIS and Tonometry Module service pages are given as HEX (hexadecimal) numbers. To understand them, please read the following:

A HEX number has a base of 16 instead of 10. This means that every character in a number can have a value between 0 and 15. Numbers from 0 to 9 are displayed as if they were normal 10-based numbers. Numbers from 10 to 15 are displayed with letters from a to f or A to F respectively.

Every character of a HEX number expands into a binary code of four 0:s (zeroes) and 1:s (ones) as given in table 9. Four successive characters thus expand into four times four binary numbers. Here's an example:

We have a HEX number F3A1. We expand the number into binary code so that we first take the four binary digits that correspond to F, which are 1111. Then we write the four binaries that correspond to 3 (0011) after the first four. We now have 11110011. And so on.

Eventually, we have a string of 16 binary numbers, so called bits. HEX number F3A1 corresponds to a binary code of 1111 0011 1010 0001. Spaces are added here for legibility and to visualize the fact that every group of four bits corresponds to one HEX character.

The bits in a binary number are numbered from right to left always starting from 0 as follows:

bit 15	bit 14	bit 13	bit 12		bit 11	bit 10	bit 9	bit 8		bit 7	bit 6	bit 5	bit 4		bit 3	bit 2	bit 1	bit 0
1	1	1	1		0	0	1	1		1	0	1	0		0	0	0	1

With this information and the proper table of status fields you can translate a HEX status code into actual status messages. For the tables of status fields see section "Tonometry" or "BIS" . If a bit is 1 this means that the corresponding status/error condition is valid, whereas a 0 means that it is not.

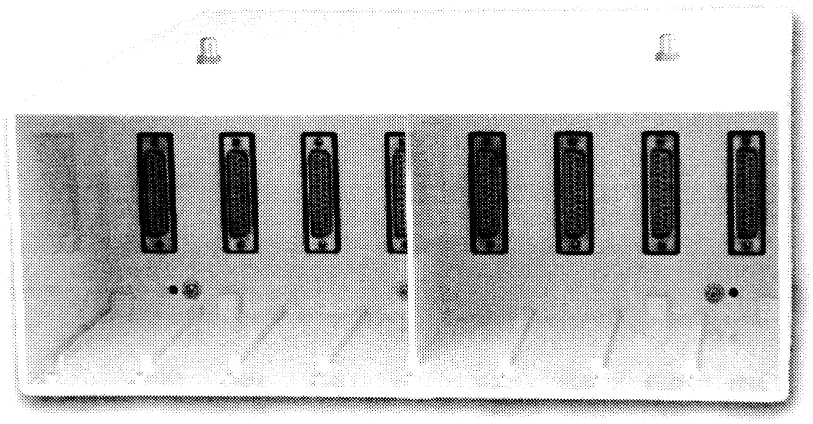
Table 15 HEX to binary conversion

HEX	binary	HEX	binary
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

Datex-Ohmeda

S/5™ 8 Module Frame, F-CU8 (Rev.10)

Technical Reference Manual Slot



All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

M1027810
May, 2005

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  - 1.1.2 Environmental requirements 2

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Introduction

This section provides information for the maintenance and service of the following products:

- 8-Module Frame, F-CU8 (also called Central Unit)
  - Power supply unit
  - CPU mother board
  - Module mother board

Information for the maintenance and service of:

  - CPU Board in “CPU Board, B-CPU5” slot
  - UPINET Board in “UPINET Board, B-UPI4NET” slot
  - Display Controller Board B-DISPX in “Displays and Display Controllers” slot

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

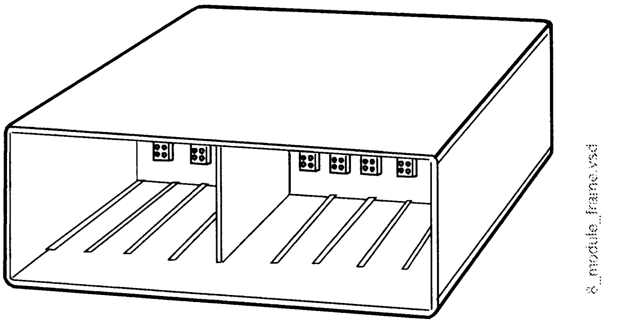


Figure 1 **8-Module Frame, F-CU8**

1 Specifications

1.1 8-Module Frame, F-CU8

Dimensions, D × W × H	382 × 315 × 128 mm (15.0 × 12.4 × 5.0 in)
Weight	9.1 kg (20 lb.)

1.1.1 Electrical requirements

Rated voltages and and frequencies	100 V, 50/60 Hz 110...120 V, 50/60 Hz 220... 240 V, 50/60 Hz
Allowed voltage fluctuations	100 V ±10% 110 V -10% to 120 V +10% 220 V -10% to 240 V +10%
Maximum power consumption	
F-CU8 Rev.03...09	280 VA
F-CU8 Rev.10	160 VA
Safety class	Class I
Grounding	Hospital grade
Interruptibility	Data memory and alarm settings are saved during power failures up to 15 minutes

1.1.2 Environmental requirements

Operating temperature	10...35 °C (50...95 °F)
Storage temperature	-10...+50 °C (14...122 °F)
Relative humidity	10...90% non-condensing (in airway 0...100% condensing)
Atmospheric pressure	660...1060 mbar (500 to 800 mmHg)

2 Functional description

2.1 8-Module Frame, F-CU8

To operate S/5 Anesthesia Monitor or S/5 Critical Care Monitor, the following products should be installed into the frame

- CPU board, B-CPU4 or B-CPU5 w/ main software
- UPI4 or UPI4NET board, B-UPI4 or B-UPI4NET
- Display controller board, B-DISPX

From F-CU8 Rev.08 onwards the CPU board, B-CPU5, the UPI4NET board, B-UPI4NET and the Display Controller Board, B-DISP, B-DISP19 or B-DISPX are included and installed into the 8 Module Frame at the factory.

The frame has two sections. The front part is for the modules. On the between the front and rear parts, there are module mother board and CPU mother board. The module mother board connects modules to the system, and the CPU mother board connects boards together.

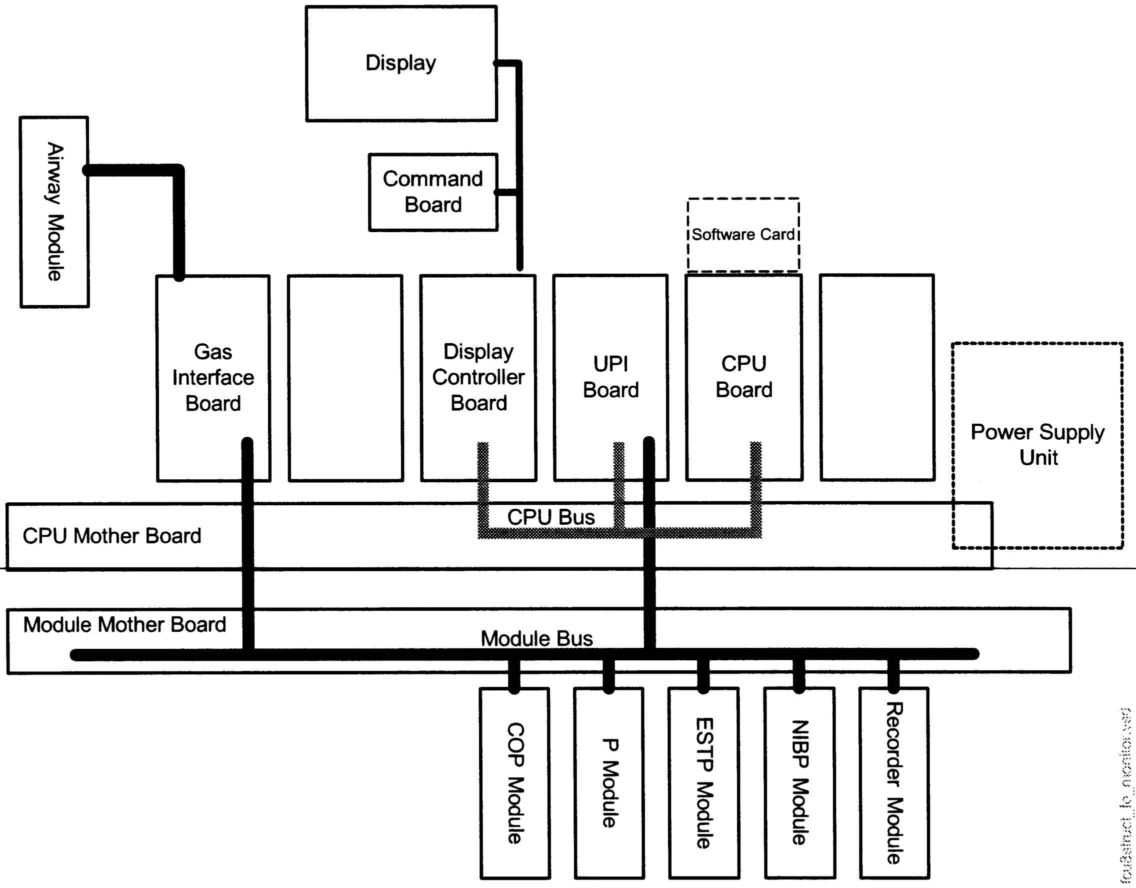
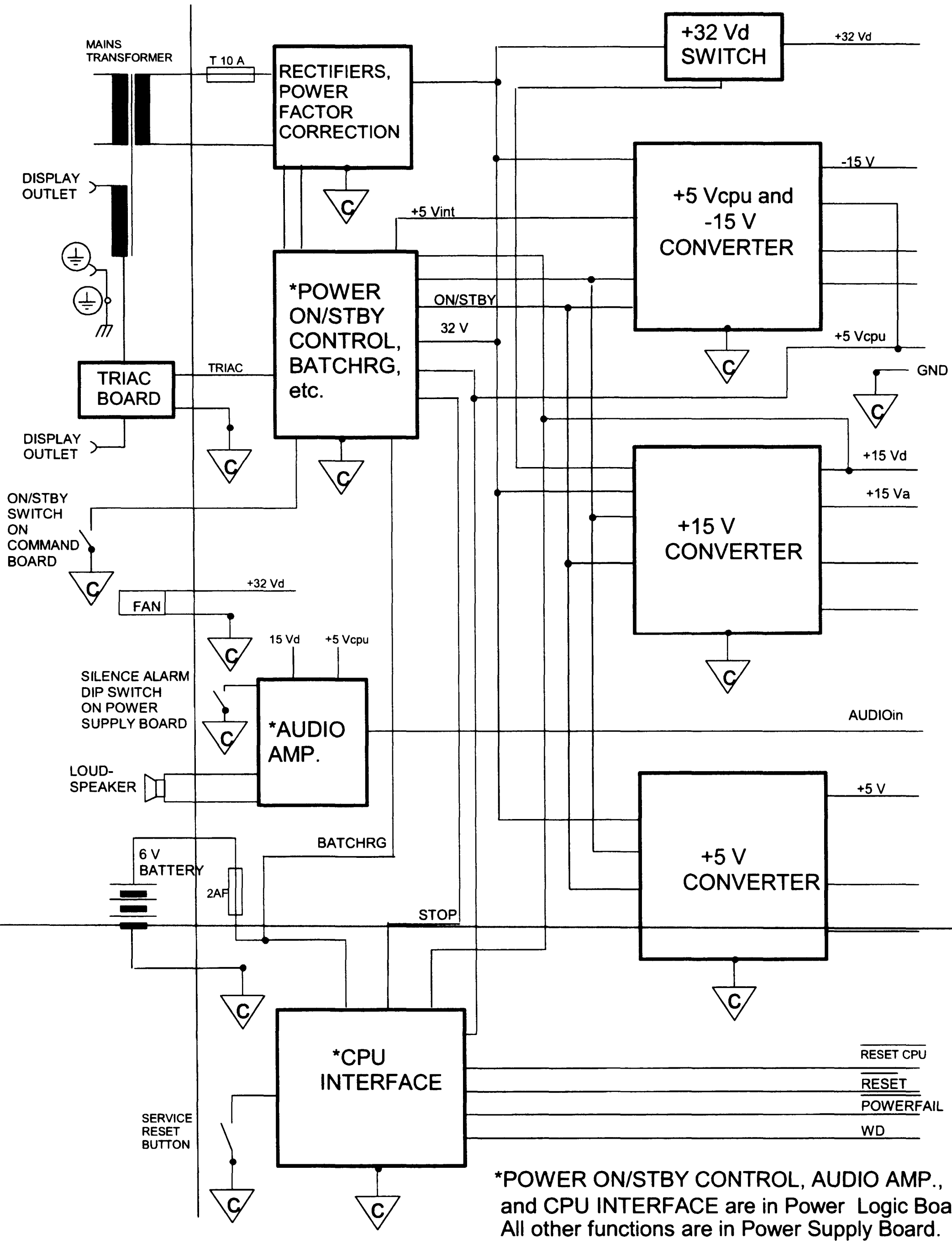

Display
Command Board
Software Card
Airway Module
Gas Interface Board
Display Controller Board
UPI Board
CPU Board
Power Supply Unit
CPU Bus
CPU Mother Board
Module Mother Board
Module Bus
COP Module
P Module
ESTP Module
NIBP Module
Recorder Module

Figure 2 **Basic structure of S/5 Monitor, an example of possible configuration**

2.1.1 Power supply unit, F-CU8 Rev.03 - 09

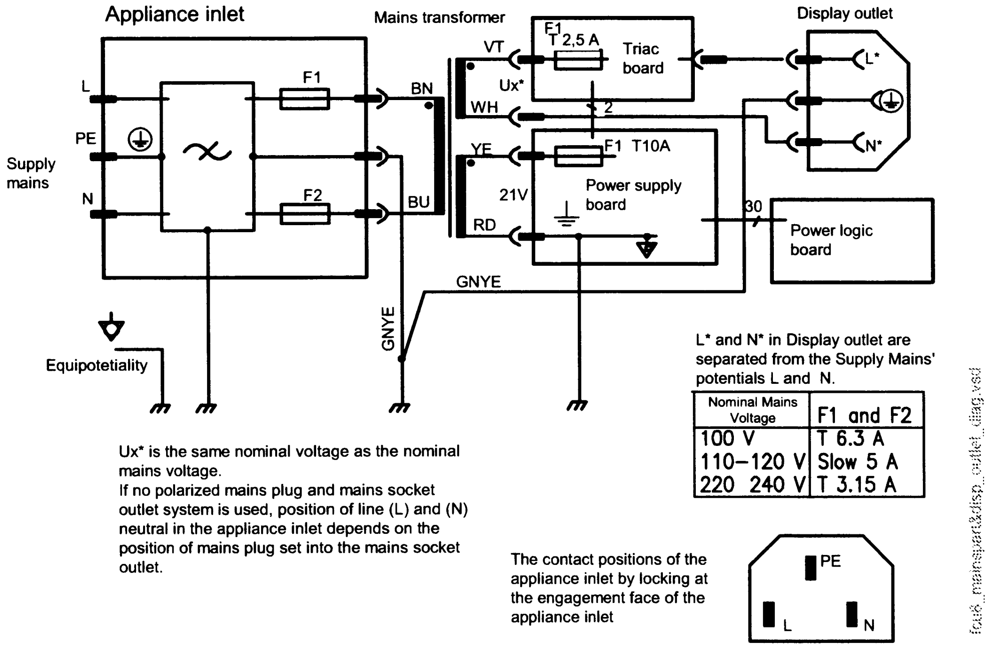
Power supply unit contains three PC boards (power supply board, power logic board, and triac board) and four external components (mains transformer, fan, loudspeaker, and lead acid battery).

All the operational controls in the power supply unit are located in the three PC boards.


MAINS TRANSFORMER
T 10 A
RECTIFIERS, POWER FACTOR CORRECTION
+32 Vd SWITCH
+32 Vd
DISPLAY OUTLET
C
+5 Vint
+5 Vcpu and -15 V CONVERTER
-15 V
*POWER ON/STBY CONTROL, BATCHRG, etc.
ON/STBY
32 V
+5 Vcpu
GND
TRIAC BOARD
TRIAC
DISPLAY OUTLET
+15 Vd
+15 Va
ON/STBY SWITCH ON COMMAND BOARD
+15 V CONVERTER
+32 Vd
FAN
15 Vd
+5 Vcpu
SILENCE ALARM DIP SWITCH ON POWER SUPPLY BOARD
*AUDIO AMP.
AUDIOin
LOUD-SPEAKER
+5 V
BATCHRG
6 V BATTERY
2AF
+5 V CONVERTER
STOP
*CPU INTERFACE
RESET CPU
RESET
POWERFAIL
WD
SERVICE RESET BUTTON

*POWER ON/STBY CONTROL, AUDIO AMP., and CPU INTERFACE are in Power Logic Board. All other functions are in Power Supply Board.

Figure 3 Power supply unit block diagram (F-CU8, rev. 03-09)


Appliance inlet
Mains transformer
Display outlet
Supply mains
L
PE
N
F1
F2
BN
BU
VT
Ux*
WH
YE
21V
RD
F1
T 2,5 A
Triac board
2
F1 T10A
Power supply board
30
Power logic board
L*
N*
GNYE
GNYE
Equipotetiality
PE
L
N
fcu8_mainspart&disp_outlet_diag.vsd

Ux* is the same nominal voltage as the nominal mains voltage.
If no polarized mains plug and mains socket outlet system is used, position of line (L) and (N) neutral in the appliance inlet depends on the position of mains plug set into the mains socket outlet.

L* and N* in Display outlet are separated from the Supply Mains' potentials L and N.

Nominal Mains Voltage	F1 and F2
100 V	T 6.3 A
110–120 V	Slow 5 A
220 240 V	T 3.15 A

The contact positions of the appliance inlet by locking at the engagement face of the appliance inlet

Figure 4 **Mains part and display outlet block diagram (F-CU8, rev. 03-09)**

Power supply board

Rectifiers

Rectifiers processes 21 VAC from the mains transformer.

Power factor correction

Power factor correction is performed in a pre regulator. The regulator modifies output current from sinusoidal power lines into sinusoidal form. Its purpose is to boost efficiency of the mains transformer.

Battery charging

Batchrg charges the 6 V battery which maintains the supply voltage of CPU for 15 minutes after the power is cut off. The battery is charged as long as the power cord is connected to the mains outlet.

Supply voltage for pulse width modulators

Supply voltage for pulse width modulators of chopper power supplies is generated by 12 V regulator at power-up and if +15 V is short-circuited. Otherwise the supply voltage comes from +15 V.

-15 V converter

-15 V converter is a Flyback-type chopper power supply that generates -15 V analog voltage from +32 V. The load capacity is 500 mA (7.5 W). +5 Vcpu is also generated in this converter.

+15 V converter

+15 V converter is a Buck-type chopper power supply that generates +15 V from +32 V.

The output of the power supply is divided into two; +15 Va for analog voltage and +15 Vd for less sensitive components.

+5 V converter

+5 V converter is a Buck-type chopper power supply that generates +5.1 V from +32 V. The load capacity is 8 A (40 W).

+5 V, +15 V, +32 V, and +5 Vcpu checking

Those voltages are checked and if one of them increases more than is allowed, thyristor pulls the rectified +32 V down.

Service reset button

Service reset button is for service purpose. Press this button with an appropriate tool for at least five seconds before you remove any PC board or the Power supply unit from the rear of the Central Unit.

Before connecting the power cord back and start monitoring, be sure that at least one minute has passed after the service reset button has pressed. Too short time may lead to memory flaw.

Audible alarm for power fail

Under the cover plate of the Power supply unit there are two dip switches. By turning the switches to the left the audio alarm is activated. When mains power fails the audio alarm is generated by the lead-acid battery.

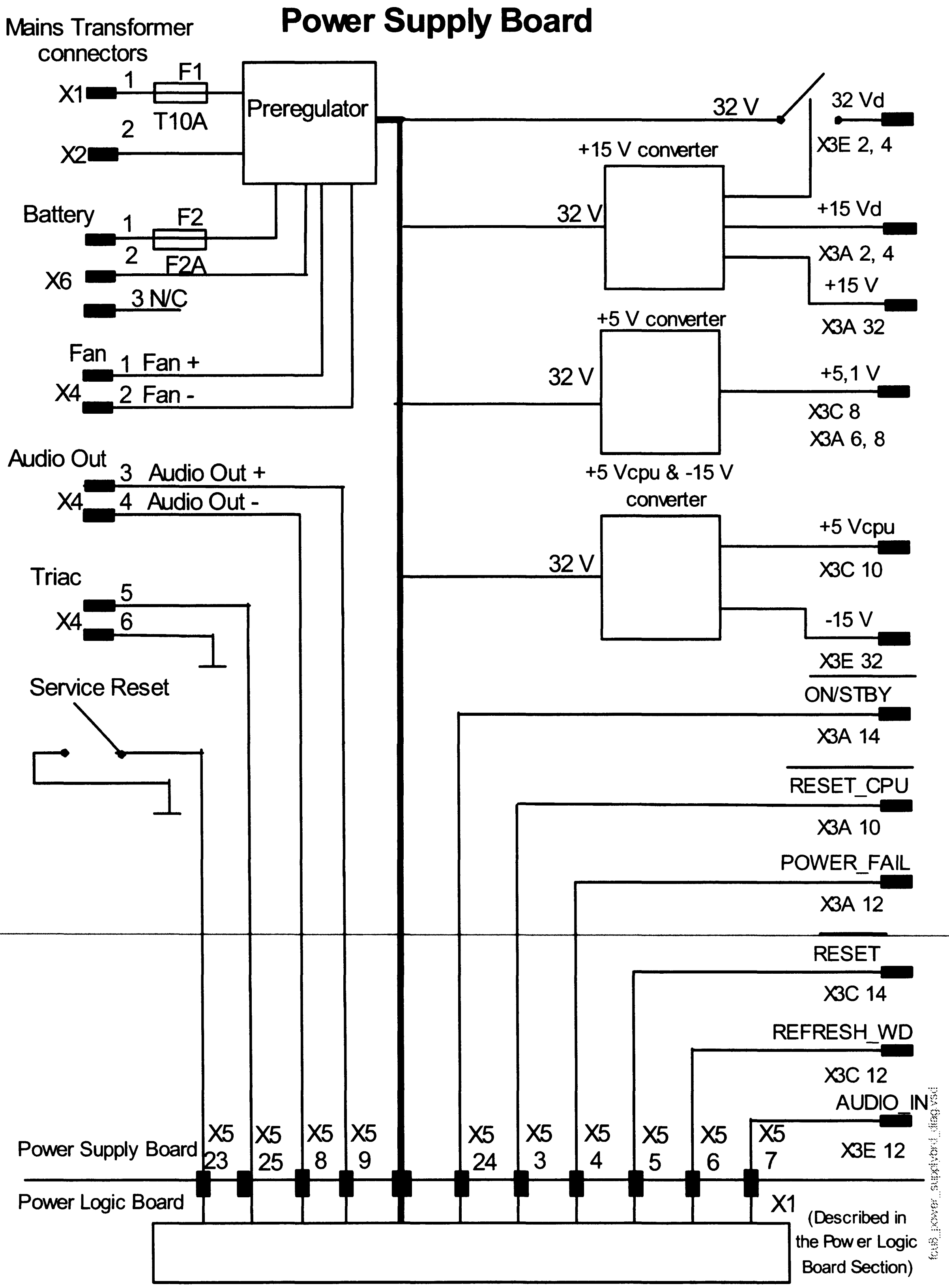

Power Supply Board
Mains Transformer connectors
X1
1
F1
T10A
2
X2
Preregulator
32 V
32 Vd
X3E 2, 4
+15 V converter
32 V
+15 Vd
X3A 2, 4
+15 V
X3A 32
Battery
1
F2
2
F2A
X6
3 N/C
+5 V converter
32 V
+5,1 V
X3C 8
X3A 6, 8
Fan
1 Fan +
X4
2 Fan -
Audio Out
3 Audio Out +
X4
4 Audio Out -
+5 Vcpu & -15 V converter
32 V
+5 Vcpu
X3C 10
-15 V
X3E 32
Triac
5
X4
6
Service Reset
ON/STBY
X3A 14
RESET_CPU
X3A 10
POWER_FAIL
X3A 12
RESET
X3C 14
REFRESH_WD
X3C 12
AUDIO_IN
X3E 12
Power Supply Board
X5 23
X5 25
X5 8
X5 9
X5 24
X5 3
X5 4
X5 5
X5 6
X5 7
Power Logic Board
X1
(Described in the Power Logic Board Section)

Figure 5 **Power supply board block diagram (F-CU8, rev. 03-09)**

Power supply board interface to CPU mother board

Pin c2,c4: +32 Vd

Rectified and filtered +32 V dirty voltage. This voltage is switched on by pulses of +15 V chopper power supply which turns the switching transistor on with the help of charging pump. The switching transistor is a short-circuit protected MOSFET. The ripple voltage when fully loaded is about 3 Vpp at the frequency of two times mains frequency.

Pin c32: -15 V

Accuracy of -15 V is ±2%. The load capacity is 500 mA and the ripple voltage about 30 mVpp at the chopper frequency (200 kHz 10%).

Pin c22: f (-15 V)

The chopper frequency measured at the rear panel connector whose pulse ratio corresponds to the pulse width modulator's pulse ratio. For test use only.

Pin c20: st (-15 V)

The chopper can be turned off by connecting this line at the rear panel connector to ground. For test use only.

Pin a2,a4: +15 Vd

Accuracy of +15 V is ±2%. The load capacity is 6.5 A if +15 Va is not loaded. The ripple voltage about 50 mVpp at the chopper frequency (200 kHz ±10%).

Pin 32: +15 Va

+15 V for analog voltage. The load capacity is 1.2 A and is passive filtered from +15 Vd. The ripple voltage about 10 mVpp at the chopper frequency (200 kHz ±10%).

The total load capacity of +15 Va and +15 Vd is about 6.5 A (97.5 W).

Pin b22: f (+15 V)

The chopper frequency measured at the rear panel connector whose pulse ratio corresponds to the pulse width modulator's pulse ratio. For test use only.

Pin b20: st (+15 V)

The chopper can be turned off by connecting this line at the rear panel connector to ground. For test use only.

Pin a6,a8,b8: +5 V

Nominal voltage is 5.1 V and its accuracy is ±2%. The load capacity is 8 A. The ripple voltage about 50 mVpp at the chopper frequency (200 kHz ±10%).

Pin a22: f (+5 V)

The chopper frequency measured at the rear panel connector whose pulse ratio corresponds to the pulse width modulator's pulse ratio. For test use only.

Pin a20: st (+5 V)

The chopper can be turned off by connecting this line at the rear panel connector to ground. For test use only.

Pin b10: +5 Vcpu

Supply voltage for the CPU. Nominal voltage is 5.1 V. The accuracy is ±2% and the load capacity 1 A. The ripple voltage is 50 mVpp. The +5 Vcpu is connected to linearly regulated battery voltage when the choppers are switched off.

Pin b14: -RESET

Signal for the digital boards.

Pin a10: -RESET CPU

Signal for the CPU.

Pin a12: -POWERFAIL

The signal informs about supply voltage failure to the CPU.

Pin b12: WD

Watchdog input signal. The CPU must toggle WD within every 1.6 seconds. Otherwise the power supply will generate -RESET and -RESET CPU signals.

Pin c12: AUDIOin

Audio signal which is amplified in Audio-amp. circuit.

Ground

All the signals and lines within the Power supply unit share the common ground which is connected to monitor chassis.

Power logic board

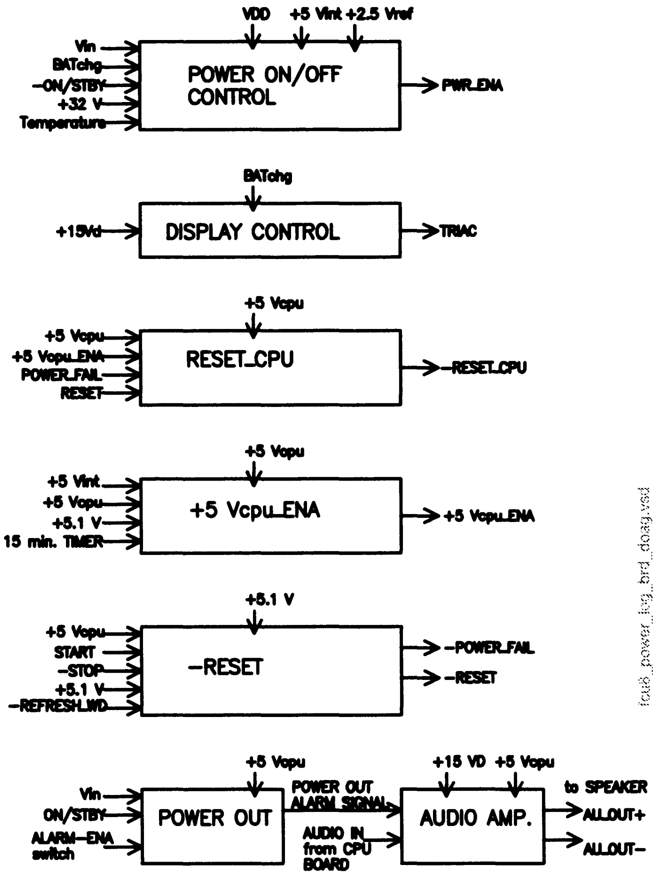

VDD
+5 Vint
+2.5 Vref
Vin
BATchg
-ON/STBY
+32 V
Temperature
POWER ON/OFF CONTROL
PWR_ENA
BATchg
+15Vd
DISPLAY CONTROL
TRIAC
+5 Vcpu
+5 Vcpu
+5 Vcpu_ENA
POWER_FAIL
RESET
RESET_CPU
-RESET_CPU
+5 Vcpu
+5 Vint
+5 Vcpu
+5.1 V
15 min. TIMER
+5 Vcpu_ENA
+5 Vcpu_ENA
+5.1 V
+5 Vcpu
START
-STOP
+5.1 V
-REFRESH_WD
-RESET
-POWER_FAIL
-RESET
+5 Vcpu
Vin
ON/STBY
ALARM-ENA switch
POWER OUT
POWER OUT ALARM SIGNAL
AUDIO IN from CPU BOARD
+15 VD
+5 Vcpu
AUDIO AMP.
to SPEAKER
ALLOUT+
ALLOUT-
fcu8_power_log_brd_diag.vsd

Figure 6 **Power logic board block diagram (F-CU8, rev. 03-09)**

Protections

These following protections generate automatic power off situations without any message in advance.

1. High voltage protection (+32 V, +15 V, +5 V, +5 Vcpu). Requires manual start-up and power cord must be disconnected for a while. Valid from revision 03.
2. Low voltage protection (+32 V). Automatic power off when U < +25 V. Automatic start-up after voltage back to normal.
3. High current protection (all secondary outputs). Output restrained until cause is eliminated.
4. High temperature protection. Automatic power off at +58 °C (approx.) and automatic start-up at +54 °C (approx.). Possible caused by fan failure, fan filter is not clean or power supply unit is overloaded. The measurement is located on the Power logic board.

Power ON/STBY control

Power ON/STBY control includes a logic with which power supply is switched on or off by turning ON/STBY switch.

Reset

-RESET_CPU signal is transmitted to the CPU interface in case the mains voltage fails or the power is cut off.

-RESET signal is also generated for other digital boards.

Audio amp.

Audio signal from the CPU is amplified and filtered for the loudspeaker. Amplification gain is about 5 dB.

CPU interface

All the necessary communications between the Power supply unit and the CPU (Reset-, powerfail-, and watchdog-functions) are realized in this board. Additionally, the block contains a circuit that supervises the maintenance of CPU's supply voltage from the battery for 15 minutes after monitor is turned off.

Display control

Display control circuit controls Triac board control signal (TRIAC).

Triac board

Tasks of the Triac board are to supply voltage to the Video display when the monitor is turned on and cut off the voltage when it is turned off. This is done by a solid state relay and peripheral components.

External components

Transformer

The power of the mains transformer is 250 VA. The secondary voltage is 21 VAC and for the display unit it is either 100 VAC, 115 VAC, or 230 VAC.

Depending on the voltage in use, there are three different transformers for the monitor.

Fan

The fan is switched on automatically when +32 Vd is generated.

Loudspeaker

The loudspeaker is controlled by the audio-amplifier on the Power logic board.

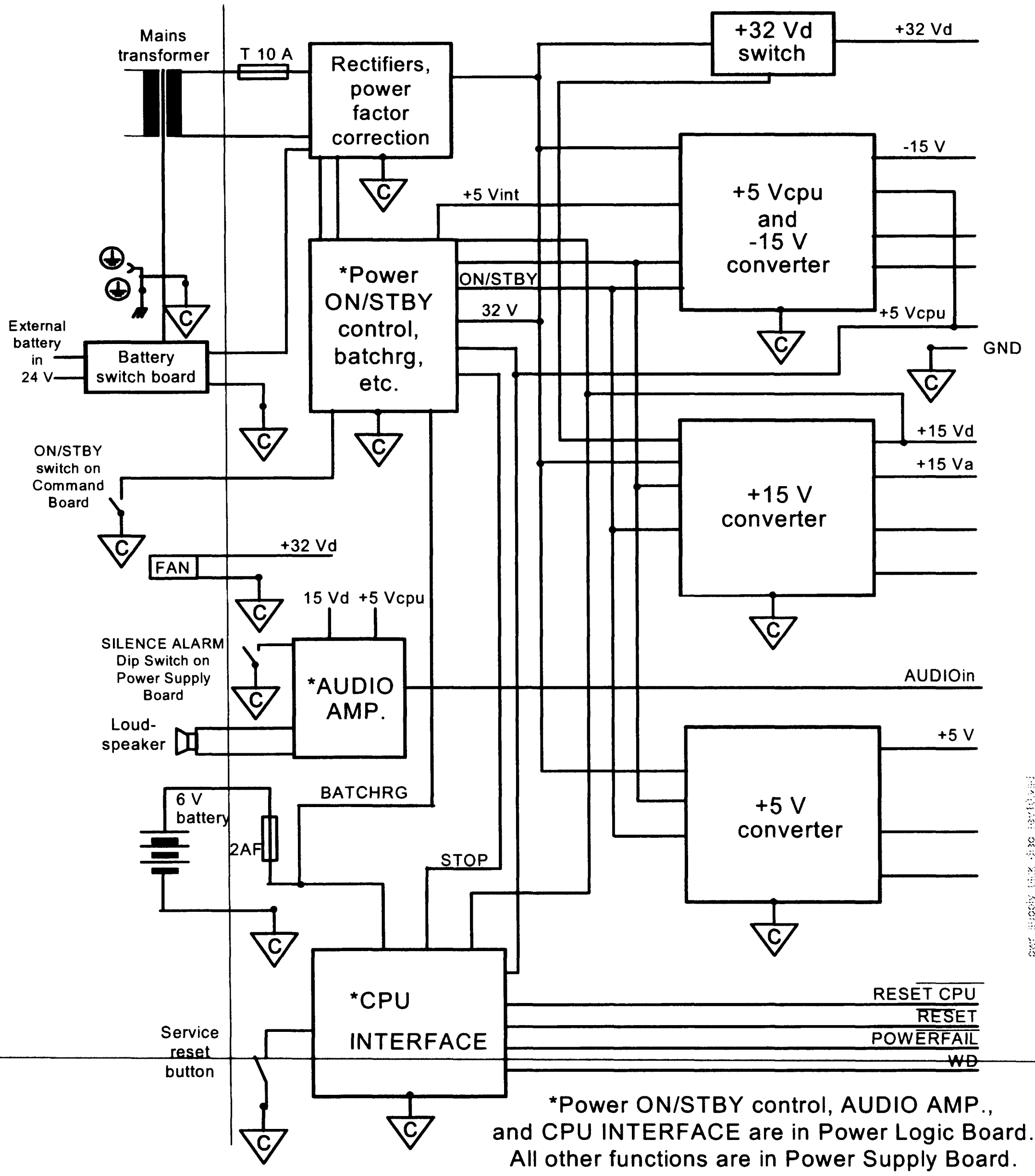
Battery

6 V, 1.2 Ah sealed lead-acid battery is used to supply power to the CPU board after the power is turned off and the power cord is disconnected.

2.1.2 Power supply unit, F-CU8 Rev.10

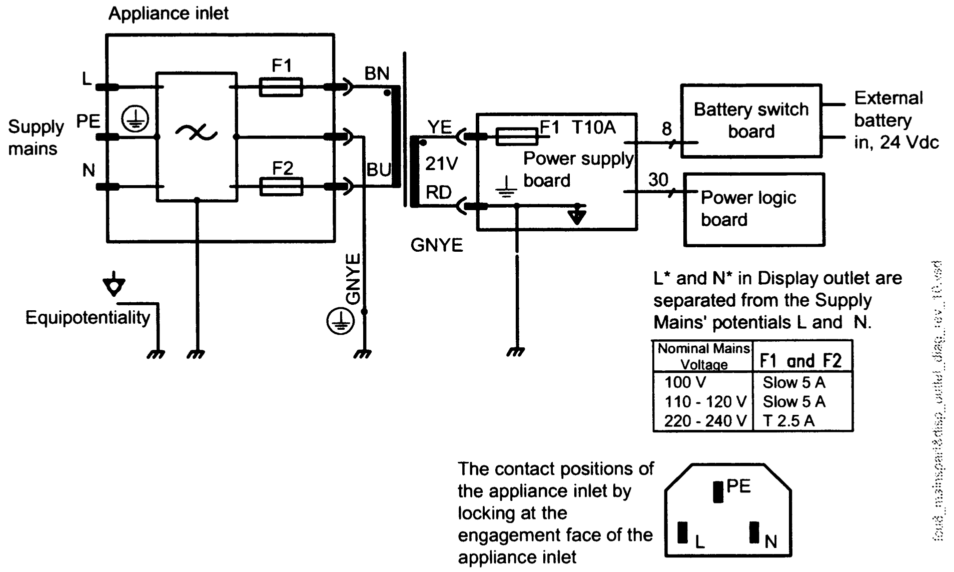
Power supply unit contains three PC boards (power supply board, power logic board, and Battery switch board) and four external components (mains transformer, fan, loudspeaker, and lead acid battery).

All the operational controls in the power supply unit are located in the three PC boards.


Mains transformer
T 10 A
Rectifiers, power factor correction
+32 Vd switch
+32 Vd
-15 V
+5 Vint
+5 Vcpu and -15 V converter
*Power ON/STBY control, batchrg, etc.
ON/STBY
32 V
+5 Vcpu
GND
External battery in 24 V
Battery switch board
+15 Vd
+15 Va
ON/STBY switch on Command Board
+15 V converter
+32 Vd
FAN
15 Vd
+5 Vcpu
SILENCE ALARM Dip Switch on Power Supply Board
*AUDIO AMP.
AUDIOin
Loud-speaker
+5 V
6 V battery
2AF
BATCHRG
+5 V converter
STOP
*CPU INTERFACE
Service reset button
RESET CPU
RESET
POWERFAIL
WD
C

*Power ON/STBY control, AUDIO AMP., and CPU INTERFACE are in Power Logic Board. All other functions are in Power Supply Board.

Figure 7 Power supply unit block diagram (F-CU8, rev. 10)


Appliance inlet
Supply mains
L
PE
N
F1
F2
BN
BU
YE
21V
RD
GNYE
GNYE
F1 T10A
Power supply board
8
30
Battery switch board
External battery in, 24 Vdc
Power logic board
Equipotentiality
L* and N* in Display outlet are separated from the Supply Mains' potentials L and N.
The contact positions of the appliance inlet by locking at the engagement face of the appliance inlet
PE
L
N

Nominal Mains Voltage	F1 and F2
100 V	Slow 5 A
110 - 120 V	Slow 5 A
220 - 240 V	T 2.5 A

Figure 8 Mains part and battery inlet switch block diagram (F-CU8, rev. 10)

Power supply board

Rectifiers

Rectifiers processes 21 VAC from the mains transformer.

Power factor correction

Power factor correction is performed in a pre regulator. The regulator modifies output current from sinusoidal power lines into sinusoidal form. Its purpose is to boost efficiency of the mains transformer.

Battery charging

Batchrg charges the 6 V CPU battery which maintains the supply voltage of CPU for 15 minutes after the power is cut off. The battery is charged as long as the power cord is connected to the mains outlet.

-15 V converter

-15 V converter is a Flyback-type chopper power supply that generates -15 V voltage from +32 V. The load capacity is 200 mA (7.5 W).

+15 V converter

+15 V converter is a Buck-type chopper power supply that generates +15 V from +32 V.

The output of the power supply is divided into two; +15 Va for analog voltage and +15 Vd for less sensitive components.

+5 V converter

+5 V converter is a Buck-type chopper power supply that generates +5.1 V from +32 V. The load capacity is 8 A (40 W).

+5 V, +15 V, +32 V, and +5 Vcpu checking

Those voltages are checked and if one of them increases more than is allowed, thyristor pulls the rectified +32 V down.

Service reset button

Service reset button is for service purpose. Press this button with an appropriate tool for at least five seconds before you remove any PC board or the Power supply unit from the rear of the Central Unit.

Before connecting the power cord back and start monitoring, be sure that at least one minute has passed after the service reset button was pressed. Too short time may lead to memory flaw.

Audible alarm for power fail

Inside the Power supply unit there are two dip switches. By turning the switches up the audio alarm is activated. When mains power fails the audio alarm is powered from the lead-acid battery.

+32 VD switch

This short circuit protected circuit connects the dirty +32 Vd voltage.

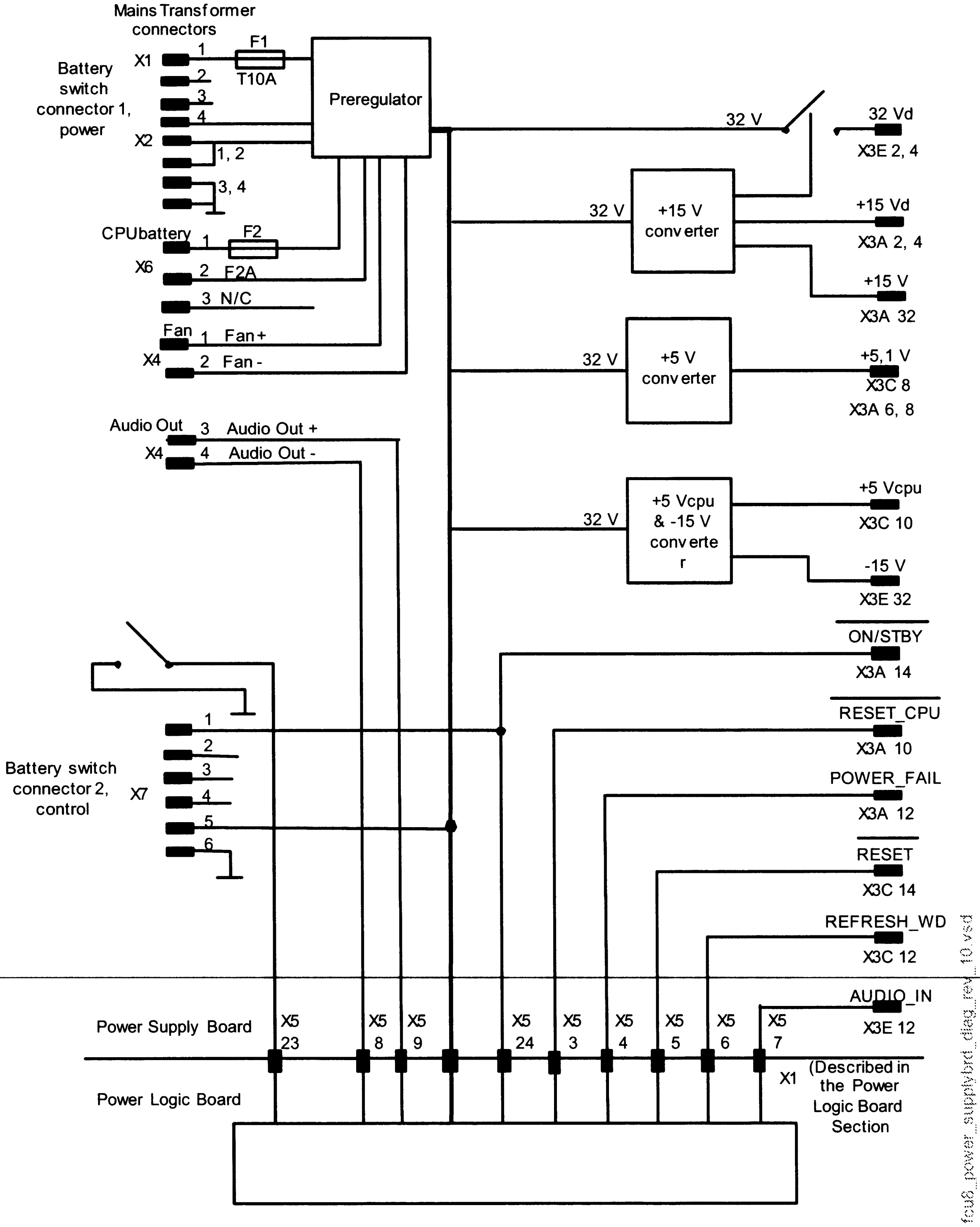

Mains Transformer connectors
Battery switch connector 1, power
X1
1
2
3
4
F1
T10A
X2
1, 2
3, 4
Preregulator
32 V
32 Vd
X3E 2, 4
CPUbattery
1
F2
X6
2
F2A
3 N/C
Fan
X4
1 Fan+
2 Fan -
32 V
+15 V converter
+15 Vd
X3A 2, 4
+15 V
X3A 32
32 V
+5 V converter
+5,1 V
X3C 8
X3A 6, 8
Audio Out
X4
3 Audio Out +
4 Audio Out -
32 V
+5 Vcpu & -15 V converter
+5 Vcpu
X3C 10
-15 V
X3E 32
ON/STBY
X3A 14
RESET_CPU
X3A 10
Battery switch connector 2, control
X7
1
2
3
4
5
6
POWER_FAIL
X3A 12
RESET
X3C 14
REFRESH_WD
X3C 12
AUDIO_IN
X3E 12
Power Supply Board
X5 23
X5 8
X5 9
X5 24
X5 3
X5 4
X5 5
X5 6
X5 7
X1
(Described in the Power Logic Board Section
Power Logic Board
fcu8_power_supplybrd_diag_rev_10.vsd

Figure 9 **Power supply board block diagram (F-CU8, rev. 10)**

Power logic board

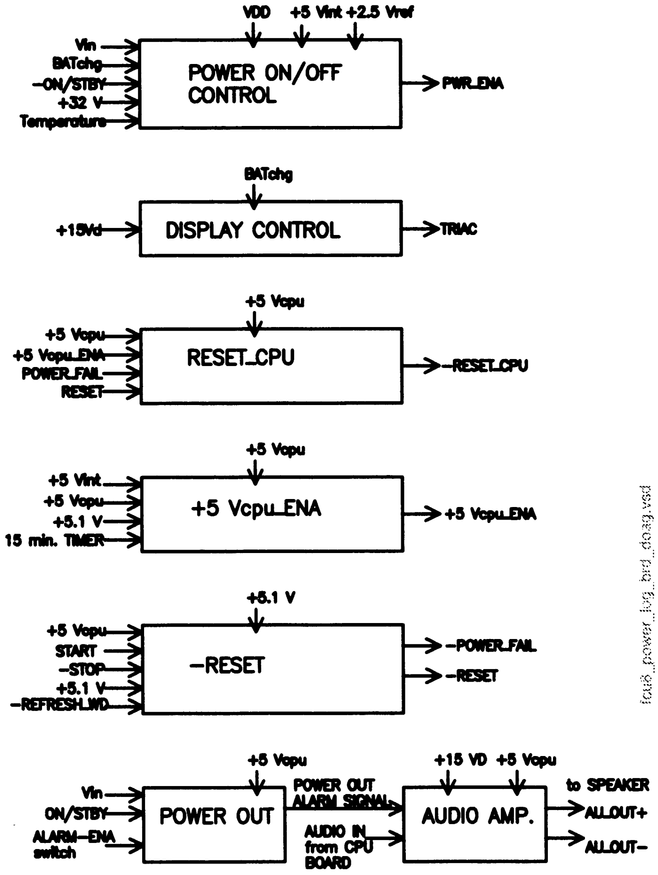

VDD
+5 Vint
+2.5 Vref
Vin
BATchg
–ON/STBY
+32 V
Temperature
POWER ON/OFF CONTROL
PWR_ENA
BATchg
+15Vd
DISPLAY CONTROL
TRIAC
+5 Vcpu
+5 Vcpu
+5 Vcpu_ENA
POWER_FAIL
RESET
RESET_CPU
–RESET_CPU
+5 Vcpu
+5 Vint
+5 Vcpu
+5.1 V
15 min. TIMER
+5 Vcpu_ENA
+5 Vcpu_ENA
+5.1 V
+5 Vcpu
START
–STOP
+5.1 V
–REFRESH_WD
–RESET
–POWER_FAIL
–RESET
+5 Vcpu
Vin
ON/STBY
ALARM–ENA switch
POWER OUT
POWER OUT ALARM SIGNAL
AUDIO IN from CPU BOARD
+15 VD
+5 Vcpu
AUDIO AMP.
to SPEAKER
ALLOUT+
ALLOUT–
fcu8_power_log_brd_diag.vsd

Figure 10 Power logic board block diagram (F-CU8, rev. 10)

Protections

These following protections generate automatic power off situations without any message in advance.

1. High voltage protection (+32 V, +15 V, +5 V, +5 Vcpu). Requires manual start-up and power cord must be disconnected for a while. Valid from revision 03.
2. Low voltage protection (+32 V). Automatic power off when U < +25 V. Automatic start-up after voltage back to normal.
3. High current protection (all secondary outputs). Output restrained until cause is eliminated.
4. High temperature protection. Automatic power off at +58 °C (approx.) and automatic start-up at +54 °C (approx.). Possible caused by fan failure, fan filter is not clean or power supply unit is overloaded. The measurement is located on the Power logic board.

Power ON/STBY control

Power ON/STBY control includes a logic with which power supply is switched on or off by turning ON/STBY switch.

Reset

-RESET_CPU signal is transmitted to the CPU interface in case the mains voltage fails or the power is cut off.

-RESET signal is also generated for other digital boards.

Audio amp.

Audio signal from the CPU is amplified and filtered for the loudspeaker. Amplification gain is about 5 dB.

CPU interface

All the necessary communications between the Power supply unit and the CPU (Reset-, powerfail-, and watchdog-functions) are realized in this board. Additionally, the block contains a circuit that supervises the maintenance of CPU's supply voltage from the battery for 15 minutes after monitor is turned off.

Battery switch board

The Battery switch board switches the F-CU8 to external battery power, if mains power is lost. The board incorporates a charger for external batteries (not in use) and routes the ON/STBY -line to the external battery connector at the rear of the F-CU8.

External components

Transformer

The power of the mains transformer is 160 VA. The secondary voltage is 21 VAC .

Depending on the voltage in use, there are three different transformers for the monitor 100 VAC, 110-120 VAC or 220-240 VAC.

Fan

The fan is switched on automatically when +32 Vd is generated (= power ON).

Loudspeaker

The loudspeaker is controlled by the audio-amplifier on the Power logic board.

Battery

6 V, 1.2 Ah sealed lead-acid battery is used to supply power to the CPU board after the power is turned off and the power cord is disconnected. 15 min timer.

2.1.3 CPU mother board

The CPU mother board connects the CPU board and other boards (e.g. UPI4 and Display controller board) and functions as a bus between them.

There are connectors for six PC boards. Five of those are normally occupied (B-UPI4(NET), B-CPU4 or B-CPU5, B-DISP and B-GAS or B-INT) and one is reserved for, e.g. Keyboard interface board, B-ARK. The bus structure is the same in all S/5 monitors.

ON/STBY-line is connected only to a Display controller board connector from where it goes directly to Keyboard and ON/STBY switch. The CPU mother board is connected to module mother board by 25-pin D-connector.

2.1.4 Module mother board

This board connects the modules and the main frame together electrically. Module bus structure is the same in all S/5 monitors. There are connectors for 4 double-width or 8 single-width modules.

2.2 Connectors and signals

2.2.1 External connectors

Table 1 Main power F-CU8

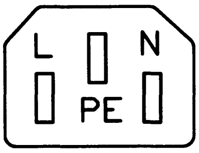
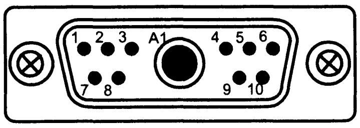
Mains connector	Pin	Signal
	L	Live
	PE	Protected earth
	N	Neutral

Table 2 24Vdc in connector(Battery backup in) F-CU8 rev.10

Connector: 11W1	Pin	I/O	Signal
	A1		GND
	1		GND
	2	-	NC
	3	O	STBY/ON
	4	I	24 Vdc
	5	I	24 Vdc
	6	I	24 Vdc
	7	I	24 Vdc
	8	I	24 Vdc
	9	O	EXT_BAT_CHARGE
	10		GND
	Shield		Cable shield, GND, metal case

2.2.2 Internal connectors

Table 3 F-CU8 Rev.03-09, Power supply (X3) - CPU mother board connector

Pin	a(a)	b(c)	c(e)
2	+15 VD	GND	+32 VD
4	+15 VD	GND	+32 VD
6	+5 V	GND	GND
8	+5 V	+5 V	GND
10	RESET_CPU	+5 V_CPU	GND
12	POWER_FAIL	REFRESH_WD1	LOUDSPEAKER
14	ON/STBY	RESET	N/C

Pin	**a(a)**	**b(c)**	**c(e)**
16	N/C	N/C	N/C
18	GND	GND	GND
20	TEST1 N/C	TEST2 N/C	TEST3 N/C
22	TEST4 N/C	TEST5 N/C	TEST6 N/C
24	TEST7 N/C	TEST8 N/C	TEST9 N/C
26	GND	GND	GND
28	BAT_ON N/C	V_BAT N/C	I_BAT N/C
30	N/C	GND	N/C
32	+15 V	GND	-15 V

Table 4 F-CU8 Rev.10, Power supply (X3) - CPU mother board connector

Pin	**(a)**	**(c)**	**(e)**
2	+15 VD	GND	+32 VD
4	+15 VD	GND	+32 VD
6	+5 V	GND	GND
8	+5 V	+5 V	GND
10	RESET_CPU	+5 V_CPU	GND
12	POWER_FAIL	REFRESH_WD	AUDIO_IN
14	ON/STBY	RESET	AL_OR_BAT
16	SERVRST	ALARMENA	N/C
18	GND	GND	GND
20	TEST1 N/C	TEST2 N/C	N/C
22	TEST4 N/C	TEST5 N/C	TEST6 N/C
24	TEST7 N/C	N/C	N/C
26	GND	GND	GND
28	BAT_ON N/C	TEST8 N/C	N/C
30	N/C	GND	N/C
32	+15 V	GND	-15 V

3 Service procedures

3.1 General service information

The field service of the F-CU8 is limited to replacing the faulty printed circuit boards or mechanical parts. The printed circuit boards should be returned to Datex-Ohmeda for repair.

Datex-Ohmeda is always available for service advice. Please provide the unit serial number, full type designation, and a detailed description of the fault.

CAUTION Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.2 Service check

These instructions include complete procedures for a service check. The service check is recommended to be performed after any service repair. However, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form (APPENDIX A) which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check form should be signed after performing the procedure.

3.2.1 Recommended tools

Tool	**Order No.**	**Notes**
Command Board		
E-REC/ M-REC		
Hemodynamic Multiparameter Module		
Oscilloscope		
~~Patient Simulator~~		
Multimeter		
Screwdriver		

3.2.2 Recommended parts

Part	**Order No.**	**Notes**
Recorder paper		
Fan filter	871558	

3.2.3 Visual inspection

Make sure that no cables or modules are connected to the Central Unit. Lift off the Video display with its stand, if placed on the Central Unit.

8-Module Frame, F-CU8

1. Frame

   Check that the central unitis intact.

   ✍

2. Brass plugs

   Check that the two brass plugs on the frame are tightened properly.

   ✍

3. Pads and screws

   Turn the frame onto one of its sides. Check that all the four rubber pads are in place and the screws on the bottom are tightened properly.

   ✍

4. Loudspeaker

   Check that the loudspeaker is intact.

   ✍

5. Module motherboard connectors

   Turn the frame back to its normal position.

   Check that the module motherboard connectors are clean and intact. Check also that the screws that connect the module mother board to the frame are tightened properly.

   ✍

6. Module motherboard position

   Check that the E-REC/M-REC fits in smoothly and locks up properly in all possible slots in the Central Unit. Leave the E-REC/M-REC disconnected.

   ✍

CAUTION Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.

Power supply unit

7. Fan filter

   Clean or replace the fan filter.

   ✍

8. Primary fuses

   Disconnect the primary fuse holder. Check that the fuse compartment, the fuse holder and the fuses are clean and intact. Check also that the fuses are of the correct rating.

   Reconnect the fuse holder and check that it locks up properly.

   ✍

9. Power inlet connectors

   Check that the power inlet connectors are clean and intact.

   ✍

10. Service reset -switch

    Check that the service reset -switch is intact. Press the switch at least for five seconds.

    ✍

11. Equipotential tap and rear panel screws

    Check that the equipotential tap and all the rear panel screws are tightened properly.

    ✍

PC boards

12. PC board screws

    Check that all the rear side PC boards are secured to the Central Unit with two screws.

    ✍

13. PC board connectors

    Check that the PC boards' rear panel connectors are clean and intact.

    ✍

14. Block screws for cables

    Check that all block screws for cables are in place and tightened properly. Check also that their threads are intact.

    ✍

15. Grounding plates

    Check that the grounding plates under the PC board rear panels are attached properly and are not bent.

    NOTE: Older PC boards may not include the grounding plates.

    ✍

16. Interface board fuse(s)

    If the Central Unit has the B-INT or B-GAS installed, disconnect the board and check that the fuse and its holder are clean and intact. Check also that the fuse is of the correct rating.

    Leave the board disconnected.

    ✍

17. Display controller board jumpers/DIP switches

    Disconnect the Display controller board(s) and check that the address and interruption jumpers/ DIP switches have been set correctly. The instructions for setting the jumpers can be found in the "Displays and Display Controllers" slot of the Technical Reference Manual,

    Leave the board(s) disconnected.

    ✍

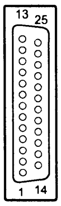
    Disconnect the UPI4(NET) board.

3.2.4 General inspection

18. Communication lines

    Measure resistance from the following Module mother board's connector pins against the ground:

Module mother board connector



Pin 1 +Reset RS485

Pin 5 -Data RS485

Pin 6 +Data RS485

Pin 8 -Reset RS485

Pin 13 Ground

Check that the resistance on each of the pins is higher than 10 kΩ. If not, replace the Module mother board.

- Reconnect the PC boards and secure them to the Central Unit with screws.

NOTE: Make sure that the cables are properly attached and secured.

- Install the video display together with the Command Board, the Hemodynamic module and M-REC. Connect the mains power cord and turn the monitor on.

  ✍

19. Fan

    Check that the fan is running.

    ✍

20. Starting

    Check that the monitor starts up properly, i.e. the alarm LEDs on the Command Bar turn blank, the start-up sound is heard from the loudspeaker and the normal monitoring screen appears. No error messages should appear on the screen.

    ✍

21. Module communication

    Check that the connected modules are recognized, i.e. the needed parameter information is shown on the screen and the E-REC/ M-REC records two lines of start-up information.
    If some parameter information is missing, check the screen configuration from the MONITOR SETUP menu.

    ✍

22. Real time clock

    Check that the clock on the screen shows correct time. Adjust the time, if necessary.

    Monitor Setup - ***Time And Date***

    NOTE: If the clock shows time 0:00 continuously (at successive start-ups), the SRAM/ TIMEKEEPER chip on the CPU board, or its battery, needs to be replaced.

    The FACTORY RESET should be performed after the replacement has been made.

    ✍

23. Loudspeaker sound

    Check the loudspeaker by setting the alarm sound:

    Alarms Setup - ***Alarm Volume***

    Test the whole volume scale from 1 to 10 by turning the ComWheel and check that the alarm volume changes correspondingly. The alarm sound should be clear and audible with all the settings.

    ✍

24. Monitor software

    Enter the service menu.

    Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

    Take down the information regarding monitor software.

    ✍

25. Content of service log

    Select SERVICE LOG from the menu. Record the Service log onto the E-REC/ M-REC by selecting RECORD LOG. Check the content of recording for possible problems, then empty the Service log by selecting RESET LOG from the menu.

    ✍

26. Voltages

Check the power supply unit output voltages through the service menu:

Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8) - ***Frame - Power Supply***

The output voltages should meet the following ranges:

+15V	14.20....15.60 V
-15V	-14.00...-15.50 V
+15VD	14.10.....15.60 V
+5V	4.70......5.40 V

If any of the voltages is out of the tolerance, replace the Power supply board .

✍

27. Watchdog circuitry

Test the Central Unit watchdog circuitry:

Monitor Setup - Install/Service (password 16-4-34) - ***Service*** (password 26-23-8) - ***Set/Test - Watchdog***

Go through the tests one by one and check that the monitor performs a restart in all other cases except when performing **WD by UPI**.

NOTE: When selecting WD BY OVERLOAD, restarting should take place approximately after 15 seconds. With the other tests, restarting takes place within a couple of seconds.

If restarting did not take place, try to locate the fault:

Watchdog --> CPU board /Power supply unit

WD by Overload --> CPU board

WD by GSP --> Primary display controller board / CPU board

✍

28. Trend retaining

Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby.

Turn the monitor to standby and disconnect the power cord. Wait for two minutes, then reconnect the power cord and turn the monitor back on. The monitor should perform a "Warm start" which means the trend information and temporary settings should still be available.

If the monitor performed a "Cold start" instead, the battery fuse or the battery needs to be replaced.

NOTE: The B-CPU2/3/4/5 require 2 Amps battery fuse (P/N 51063).

The information regarding the start-up is saved also in the Service log.

✍

29. Service reset button

    Check the service reset button. Turn the monitor to standby and press the service reset button for at least five seconds. Turn the monitor back on and check that the monitor performs a "Cold start".

    ✍

30. Recovering from power loss

    Disconnect the power cord (during operation) for a moment, reconnect it and check that the monitor recovers without problems. The monitor should perform a "Warm start".

    NOTE: F-CU8 Rev. 03 or higher may give an audible alarm during the power loss. The alarm is set by the DIP switch No. 2 on the power supply board (behind the power supply unit rear panel).

    ✍

31. Electrical safety check

    Perform an electrical safety check and a leakage current test.

    ✍

32. Functioning after electrical safety check

    Check that the Central Unit functions normally after the performed electrical safety check.

    ✍

33. Final cleaning

    Clean the Central Unit with suitable detergent.

    ✍

- Fill in all necessary documents.

3.3 Disassembly and reassembly

Disassemble the F-CU8 in the following way. See the exploded view of the frame.

1. Disconnect the power cord.
2. Remove all the parameter modules from the front of the frame.
3. Press and hold the service reset button on the rear panel of the Power supply unit for at least five seconds (until a soft sound is heard). After this the Power supply unit and all the PC boards can be detached from the frame.
4. Blank connector plates and the PC boards are pulled off after removing two screws and washers. Notice that the PC boards can be removed only in certain order.

   NOTE: The B-UPI4(NET) contains components on both sides of the PCB. Therefore, the installation of B-UPI4(NET) should be handled with extra care. Detach the board from the frame carefully by pulling it from the X3 connector (25 pin female D-connector).
5. Remove the cross recess screw M6x30 with its support plate from the bottom of the unit.
6. Remove the two screws with star washers which are at the top of the back panel of power supply unit.

Now the Power supply unit is free. Get hold of the equipotential connector pin and fuse housing, and pull the unit out. Move the unit from side to side if it does not come out smoothly. **Be careful not to damage the speaker attached to the bottom of the unit.**

7. Remove the screws at the module mother board and one screw from the bottom panel. The metal chassis to which module mother board and CPU mother board are attached can be pulled out from rear.
8. Module mother board and CPU mother board are attached to the metal chassis with screws. These boards are connected to one another by 25-pin connector.

When reassembling, reverse the order of the disassembling steps as described before. When inserting the metal chassis into the external frame, fasten the screws from the front before fastening the one thick screw on the bottom panel. This way the metal chassis can be attached as close as possible to the inner divider wall. Check that the 25 pin module connectors are exactly in the middle of the openings for the connectors in the plastic frame.

When reinstalling PC boards, push them carefully until they stop before fastening them with screws.

3.3.1 Power supply unit, F-CU8 Rev.03-09

To disassemble the power supply unit remove four screws from the top cover, disconnect the cables between the top cover and the Power supply board and then lift the cover off. Lead-acid battery and power logic board are attached to the back of the top cover. See the exploded view of the unit, see the Spareparts chapter.

Power supply board is attached to the bottom of chassis with three screws. Transformer, loudspeaker and Triac board are also attached to the bottom. Fan, mains power receptacle, and display power outlet are attached to the rear of the chassis. Rear panel is also attached to the rear of the chassis with three screws.

Reassemble in reverse order of the disassembling steps as described before. When inserting the Power supply unit back to the Central unit, make sure that the Power supply unit is properly attached to the CPU mother board before fastening the screws.

3.3.2 Power supply, F-CU8 Rev.10

To disassemble the power supply unit remove four screws from the top cover, disconnect the cables between the top cover and the Power supply board and then lift the cover off.

Lead-acid battery and power logic board are attached to the back of the top cover. See the exploded view of the unit, see the Spareparts chapter.

Power supply board is attached to the bottom of chassis with three screws. Transformer and loudspeaker are also attached to the bottom. Fan, mains power receptacle and Battery switch board are attached to the rear of the chassis. Rear panel is also attached to the rear of the chassis with three screws.

When reassembling, reverse the order of the disassembling steps as described before. When inserting the Power supply unit back to the Central unit, make sure that the Power supply unit is properly attached to the CPU mother board before fastening the screws.

3.3.3 Lead acid battery for +5Vcpu

The sealed lead-acid battery in the Power supply unit can be used for 3 to 5 years. If the trends are not stored in the memory for 15 minutes after the power is turned off and the power cord is disconnected, the fault is probably in the battery or in the battery fuse.

To replace the battery:

Remove the screw that holds the battery to the top cover of the power supply unit.

When replacing the battery, make sure the + indicated battery cable is attached to the + pole of the battery.

Dispose of the old battery according to the local regulations.

3.3.4 Replacing fuses

To replace the primary fuses:

Power supply primary fuses are located next to power cord receptacle. The fuse holder can be removed by gently pushing the locking pin above the holder (or the locking pins at both sides) and the same time pulling the holder.

CAUTION Use only fuses with specified type and ratings.

To replace the secondary fuse:

Remove the rear panel from the power supply unit by removing the two screws at the top and two screws at the bottom of the panel. Replace the fuse placed on the upper right corner.

To replace the +5Vcpu battery fuse:

Remove the power supply unit from F-CU8 frame. +5Vcpu battery fuse is located on Power board.

3.4 Adjustments and calibrations

It is not necessary to do calibrations or adjustments to the F-CU8.

4 Troubleshooting

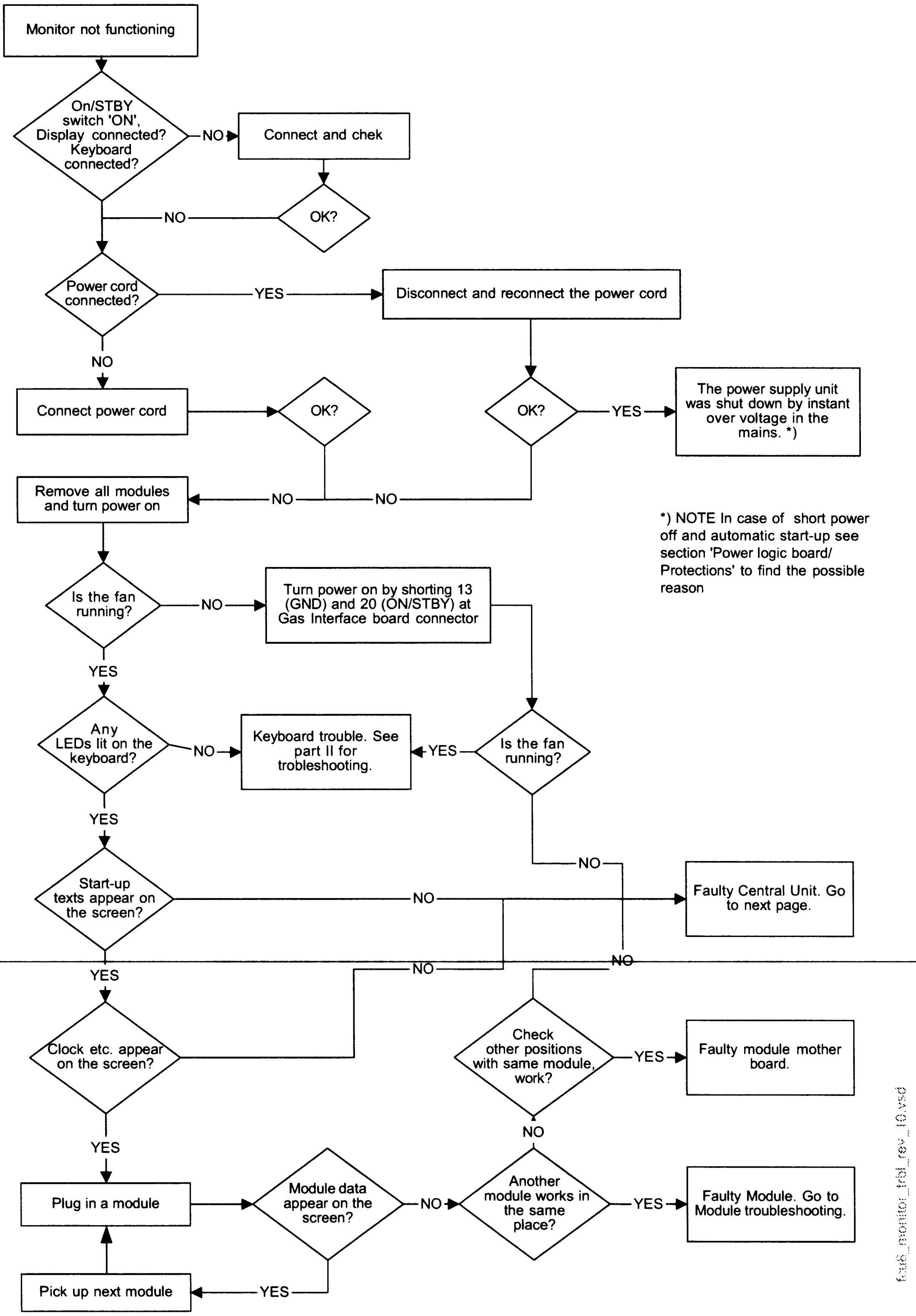

Monitor not functioning
On/STBY switch 'ON', Display connected? Keyboard connected?
NO
Connect and chek
OK?
NO
Power cord connected?
YES
Disconnect and reconnect the power cord
NO
Connect power cord
OK?
OK?
YES
The power supply unit was shut down by instant over voltage in the mains. *)
Remove all modules and turn power on
NO
NO
*) NOTE In case of short power off and automatic start-up see section 'Power logic board/ Protections' to find the possible reason
Is the fan running?
NO
Turn power on by shorting 13 (GND) and 20 (ON/STBY) at Gas Interface board connector
YES
Any LEDs lit on the keyboard?
NO
Keyboard trouble. See part II for trobleshooting.
YES
Is the fan running?
YES
NO
Start-up texts appear on the screen?
NO
Faulty Central Unit. Go to next page.
YES
NO
NO
Clock etc. appear on the screen?
Check other positions with same module, work?
YES
Faulty module mother board.
NO
YES
Plug in a module
Module data appear on the screen?
NO
Another module works in the same place?
YES
Faulty Module. Go to Module troubleshooting.
Pick up next module
YES
fcu8_monitor_trbl_rev_10.vsd

Figure 11 Monitor troubleshooting flowchart

4.1 Central Unit

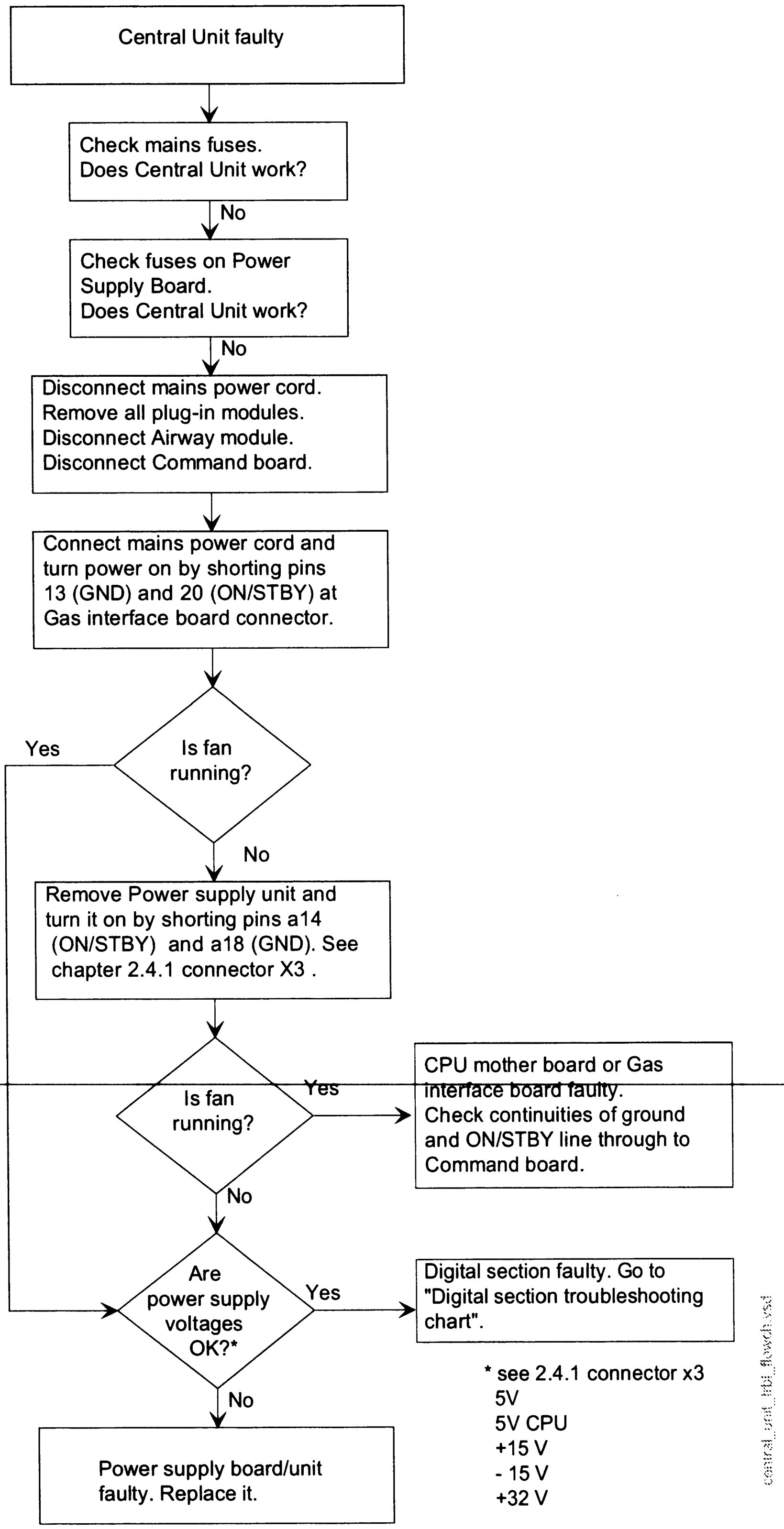

Central Unit faulty
Check mains fuses.
Does Central Unit work?
No
Check fuses on Power Supply Board.
Does Central Unit work?
No
Disconnect mains power cord.
Remove all plug-in modules.
Disconnect Airway module.
Disconnect Command board.
Connect mains power cord and turn power on by shorting pins 13 (GND) and 20 (ON/STBY) at Gas interface board connector.
Yes
Is fan running?
No
Remove Power supply unit and turn it on by shorting pins a14 (ON/STBY) and a18 (GND). See chapter 2.4.1 connector X3 .
Is fan running?
Yes
CPU mother board or Gas interface board faulty.
Check continuities of ground and ON/STBY line through to Command board.
No
Are power supply voltages OK?*
Yes
Digital section faulty. Go to "Digital section troubleshooting chart".
No
Power supply board/unit faulty. Replace it.
* see 2.4.1 connector x3
5V
5V CPU
+15 V
- 15 V
+32 V
central_unit_tbl_flowch.vsd

Figure 12 Central Unit troubleshooting flowchart

4.2 Digital section

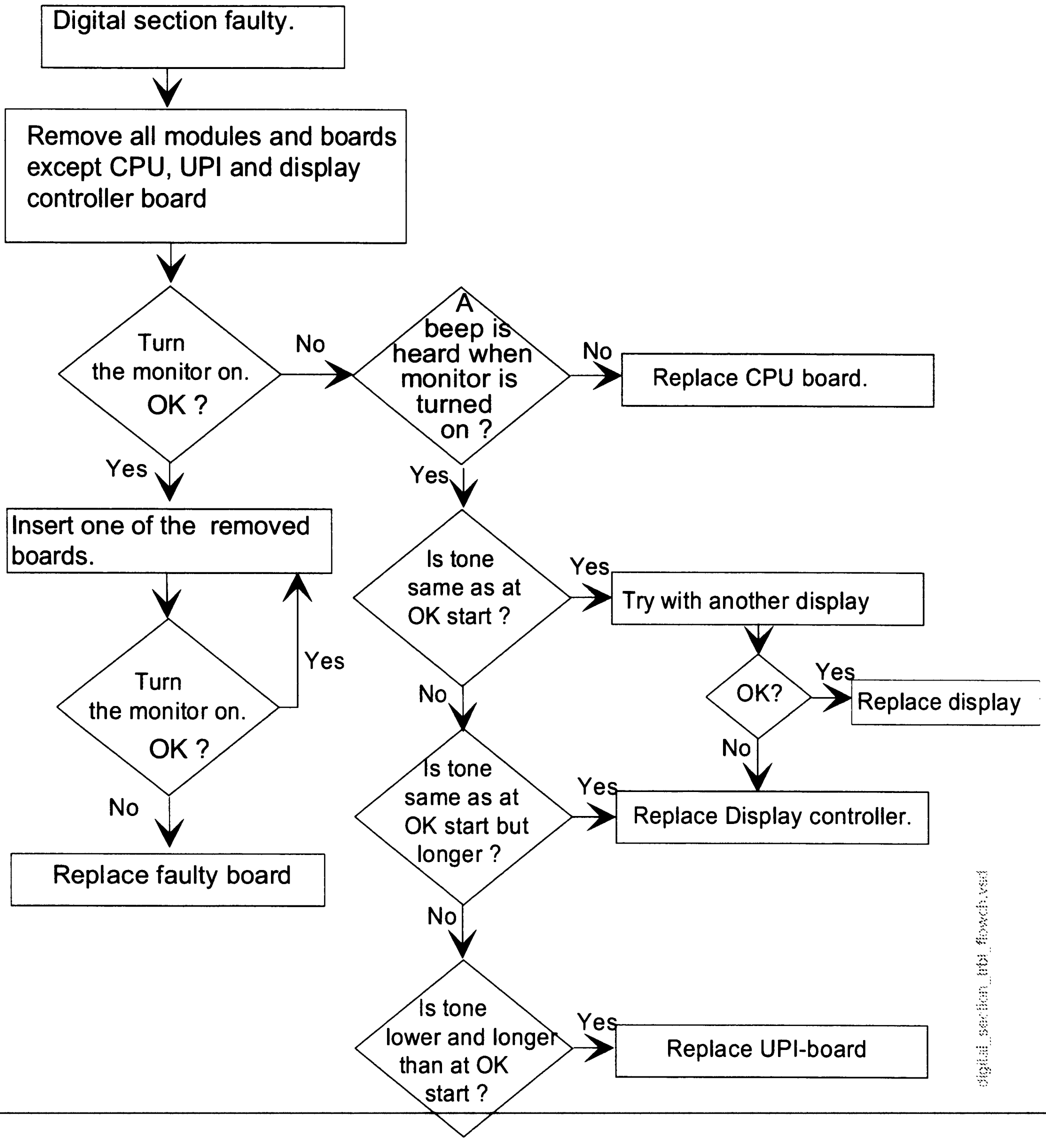

Digital section faulty.
Remove all modules and boards except CPU, UPI and display controller board
Turn the monitor on. OK ?
No
A beep is heard when monitor is turned on ?
No
Replace CPU board.
Yes
Yes
Insert one of the removed boards.
Is tone same as at OK start ?
Yes
Try with another display
Turn the monitor on. OK ?
Yes
OK?
Yes
Replace display
No
No
No
Is tone same as at OK start but longer ?
Yes
Replace Display controller.
Replace faulty board
No
Is tone lower and longer than at OK start ?
Yes
Replace UPI-board
digital_section_trbl_flowch.vsd

Figure 13 Digital section troubleshooting flowchart

5 Earlier revisions

This service manual fully supports earlier revisions except,

Item	**Manual and document number**
8-Module Frame, F-CU8 (rev 01/rev.02)	Service Manual, 880 850
CPU Board, B-CPU1 (rev 01)	Service Manual, 882 580
Software Cartridge, S-STD/S-STD93	Service Manual, 882 580
Software Cartridge, S-STD94/S-ARK94	Service Manual, 885 930
Software Cartridge, S-STD95/S-ARK95	Service Manual, 885 930
Software Cartridge, S-STD96/S-ARK96	Service Manual, 885 931
Service Menu descriptions related to software of level 97/98	Technical Reference Manual Slot 895 704
Service Menu descriptions related to software of level 99... 02	Technical Reference Manual Slot 8001003
Service Menu descriptions related to software of level 03	Technical Reference Manual Slot 8004317

APPENDIX A Service check form
Datex-Ohmeda 8-Module Frame, F-CU8

Customer		
Service	Module type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Frame	☐	☐	☐	2. Brass plugs	☐	☐	☐
3. Pads and screws	☐	☐	☐	4. Loudspeaker	☐	☐	☐
5. Module motherboard connectors	☐	☐	☐	6. Module motherboard position	☐	☐	☐
7. Fan filter	☐	☐	☐	8. Primary fuses	☐	☐	☐
9. Power inlet connectors	☐	☐	☐	10. Service reset -switch	☐	☐	☐
11. Equipotential tap and rear panel screws	☐	☐	☐	12. PC board screws	☐	☐	☐
13. PC board connectors	☐	☐	☐	14. Block screws for cables	☐	☐	☐
15. Grounding plates	☐	☐	☐	16. Interface board fuse(s)	☐	☐	☐
17. Display controller board jumpers/DIP switches	☐	☐	☐				
Notes							
18. Communication lines							

+Reset RS485 (pin 1))		>10 Ω
-Data RS485 (pin 5))		>10 Ω
+Data RS485 (pin 6)		>10 Ω
-Reset RS485 (pin 8)		>10 Ω

	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
19. Fan	☐	☐	☐	20. Starting	☐	☐	☐
21. Module communication	☐	☐	☐	22. Real time clock	☐	☐	☐
23. Loudspeaker sound	☐	☐	☐				
24. Monitor software	L-						
25. Content of service log	☐	☐	☐				
26. Voltages							
+15 V					14.20...15.60 V		
-15 V					-14.00...-15.50 V		
+15 VD					14.10...15.60 V		
+5 V					4.70...5.40 V		
	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
27. Watchdog circuitry	☐	☐	☐	28. Trend retaining	☐	☐	☐
29. Service reset button	☐	☐	☐	30. Recovering from power loss	☐	☐	☐
Notes							
31. Electrical safety check	☐	☐	☐	32. Functioning after electrical safety check	☐	☐	☐
33. Final cleaning	☐	☐	☐				

Notes

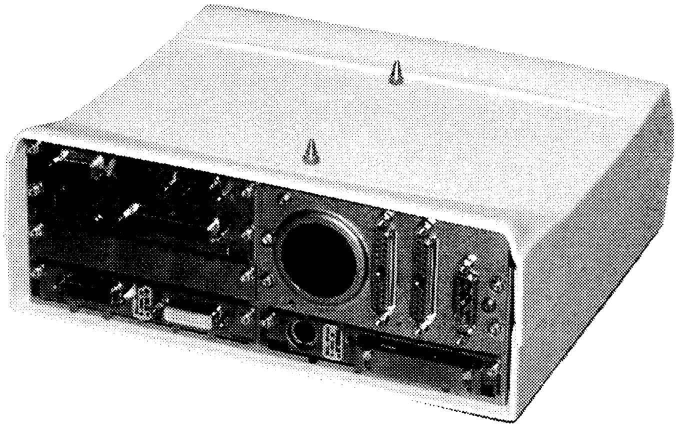
Used Spare Parts			

Signature

Datex-Ohmeda

S/5™ 5-Module Frame, F-CU5, F-CU5P
Central Processing Unit, F -CPU
F-CU5 Power Unit, N-AC

Technical Reference Manual Slot



All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

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May, 2005

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Introduction

This section provides information for the maintenance and service of the following products:

- 5-Module Frame, F-CU5(P)
  - 5-Module Frame
  - Central Processor Unit
  - F-CU5 Power Unit

Information for the maintenance and service of:

  - CPU Board in "CPU Board, B-CPU5" slot
  - UPINET Board in "UPINET Board, B-UPI4NET" slot
  - Display Controller Board B-DISPX in "Displays and Display Controllers" slot

The service menu is described in a separate "Service Menu" slot and the spare part lists in the "AM, CCM Spare Parts" slot.

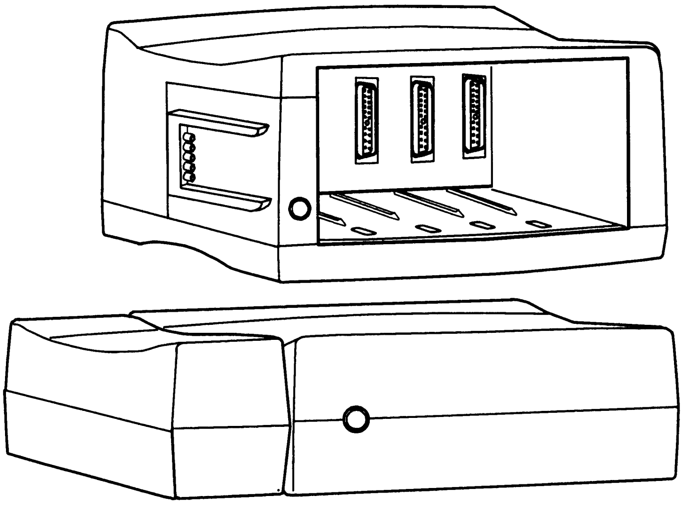


Figure 1 Parts of the 5-Module Frame, F-CU5

1 Specifications

1.1 5-Module Frame, F-CU5

The whole system

5-Module Frame, F-CU5	
Dimensions	D x W x H 233 x 244 x 142.5 mm (8.8 x 9.6 x 5.6 in)
Weight	2.5 kg (5.5 lbs)
5-Module Frame, F-CU5P	
Dimensions	D x W x H 233 x 253 x 142.5 mm (8.8 x 10.0 x 5.6 in)
Weight	2.5 kg (5.5 lbs)
Central Processing Unit, F-CPU	
Dimensions	D x W x H 224.5 x 244 x 92 mm (8.8 x 9.6 x 3.6 in)
Weight	3.1 kg (6.8 lbs)
F-CU5 Power Unit, N-AC	
Dimensions	D x W x H 238 x 66 x 78.5 mm (9.4 x 2.6 x 3.1 in)
Weight	1.1 kg (2.4 lbs)

1.1.1 Electrical requirements

Rated voltages and frequencies	100...240 V, 50/60 Hz
Allowed voltage fluctuations	100 V -10% to 240 V +10%
Maximum power consumption	150 VA
Safety class	Class I
Grounding	Hospital grade
Interruptibility	Data memory and alarm settings are saved during power failures up to 15 minutes

1.1.2 Environmental requirements

Operating temperature	10...35 °C (50...95 °F)
Storage temperature	-10...+50 °C (14...122 °F)
Relative humidity	10...90% non-condensing (in airway 0...100% condensing)
Atmospheric pressure	660...1060 mbar (500 to 800 mmHg)

2 Functional description

2.1 F-CU5 Central Unit

F-CU5 Central Unit provides places for up to five single-width modules or two double-width modules (plus one slot for one single-width module). It is also called 5-Module Frame.

F-CU5P with E-PSM(P) support provides places for up to five single-width modules or two double-width modules (plus one slot for one single-width module) and a connector plate for Patient Side Module E-PSM or E-PSMP. It is also called 5-Module Frame.

The F-CU5(P) Central Unit option includes three components:

- 5-Module Frame, F-CU5(P)
- Central Processor Unit, F-CPU
- Power Unit, N-AC

The units are connected together with appropriate cables:

- F-CPU Power Cable (0.4m/16 inch or 2.7m/9ft)
- F-CPU Signal Cable (0.3m/12inch, 3m/10ft or 10m/33ft).

NOTE: You can connect two F-CU5(P) 5-Module Frames to one F-CPU. If you do so, you cannot at the same time use a display that uses B-DISPX as power supply (for example 12" LCD display).

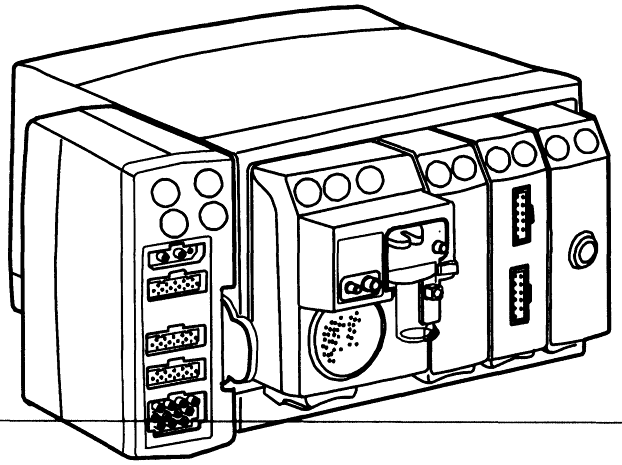


Figure 2 **5-Module Frame F-CU5P w/ modules**

To operate S/5 Anesthesia Monitor or S/5 Critical Care Monitor with 5-Module Frame, F-CU5(P), the following products should be installed:

- CPU board, B-CPU5 w/ main software L-xxx04(A) or later
- UPI4NET board, B-UPI4NET revision 01
- Display controller board, B-DISPX

The CPU board, B-CPU5, the UPI4NET board, B-UPI4NET and the Display controller board, B-DISPX are included and installed in the Central Unit, F-CPU at the factory.

NOTE: The B-INT cannot be used in the F-CPU.

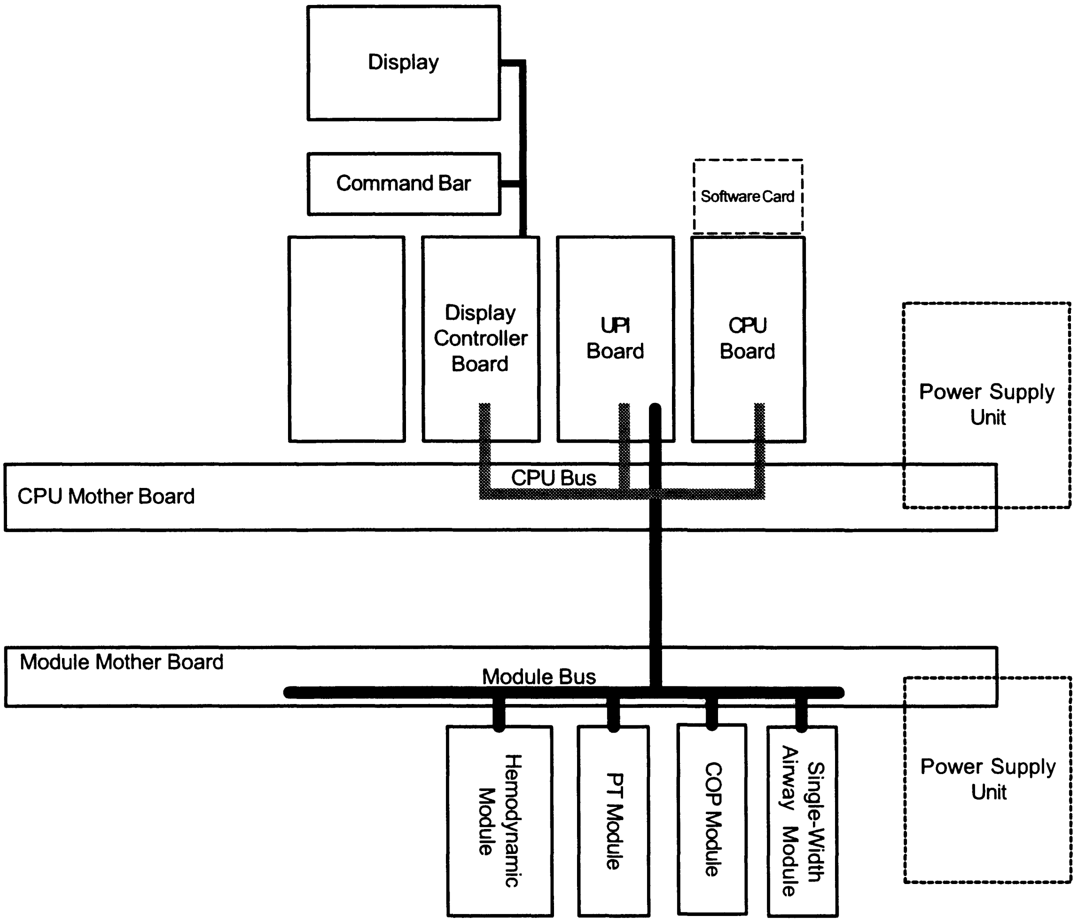

Display
Command Bar
Software Card
Display Controller Board
UPI Board
CPU Board
Power Supply Unit
CPU Mother Board
CPU Bus
Module Mother Board
Module Bus
Hemodynamic Module
PT Module
COP Module
Single-Width Airway Module
Power Supply Unit

Figure 3 Functional diagram of the 5-Module Frame F-CU5(P)

The 5-Module Frame F-CU5(P) and the Central Processor Unit F-CPU include separate power supplies, which are fed by the F-CU5 Power Unit, N-AC.

2.2 F-CU5 Power Unit, N-AC

The F-CU5 Power Unit, N-AC is intended to be connected to standard mains supply to deliver DC power for the switched mode power supplies of the 5-Module Frame, F-CU5(P) and the Central Processor Unit, F-CPU. The operating voltage level is of 24...35V (rated voltage 32V).

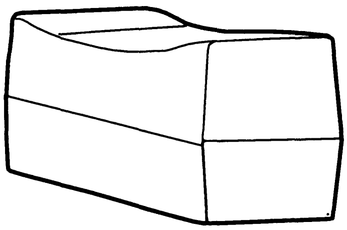


Figure 4 F-CU5 Power Unit, N-AC

DC Output

Rated output voltage of the power unit		32Vdc
min ... max range		24Vdc ... 35Vdc
ripple of the voltage		200mV (peak to peak).
Maximum output current from the power unit		6.25A
nominal value		3.125A

In short circuit condition the current is limited to 15A.

Output power of the power unit	nominal	100W
	maximum	120W

The efficiency of the power unit is >0.8 with maximum output power.
There is over temperature protection in the power unit at 50°C, and the recovery occurs at 45°C.

F-CPU Power Cable

The F-CU5 Power Unit is connected to the Central Processor Unit, F-CPU with the F-CPU Power Cable (0.4m/16 inch or 2.7m/9ft).

Cooling fan

The F-CU5 Power Supply, N-AC, cannot be repaired in the field, except the cooling fan assembly of the power unit.

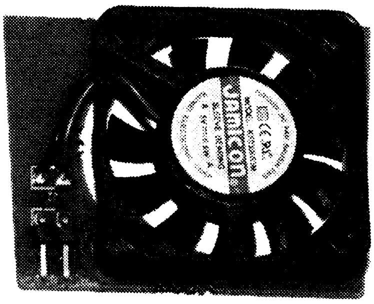


Figure 5 The fan assembly of the Power Unit

2.3 Central Processor Unit, F-CPU

~~The Central Processor unit contains CPU mother board, its own DC power board and PC board slots for~~ Display Controller Board, B-DISPX (maximum 2 pcs), UPI4NET board, B-UPI4NET and CPU board, B-CPU5. The CPU mother board connects the boards together. It also contains the internal battery for restoring the patient data for 15 min after shut down.

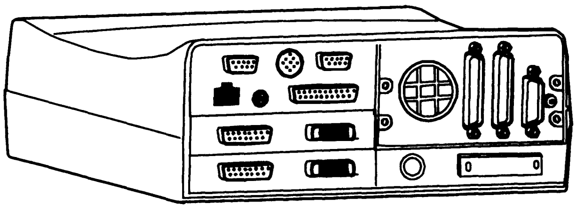


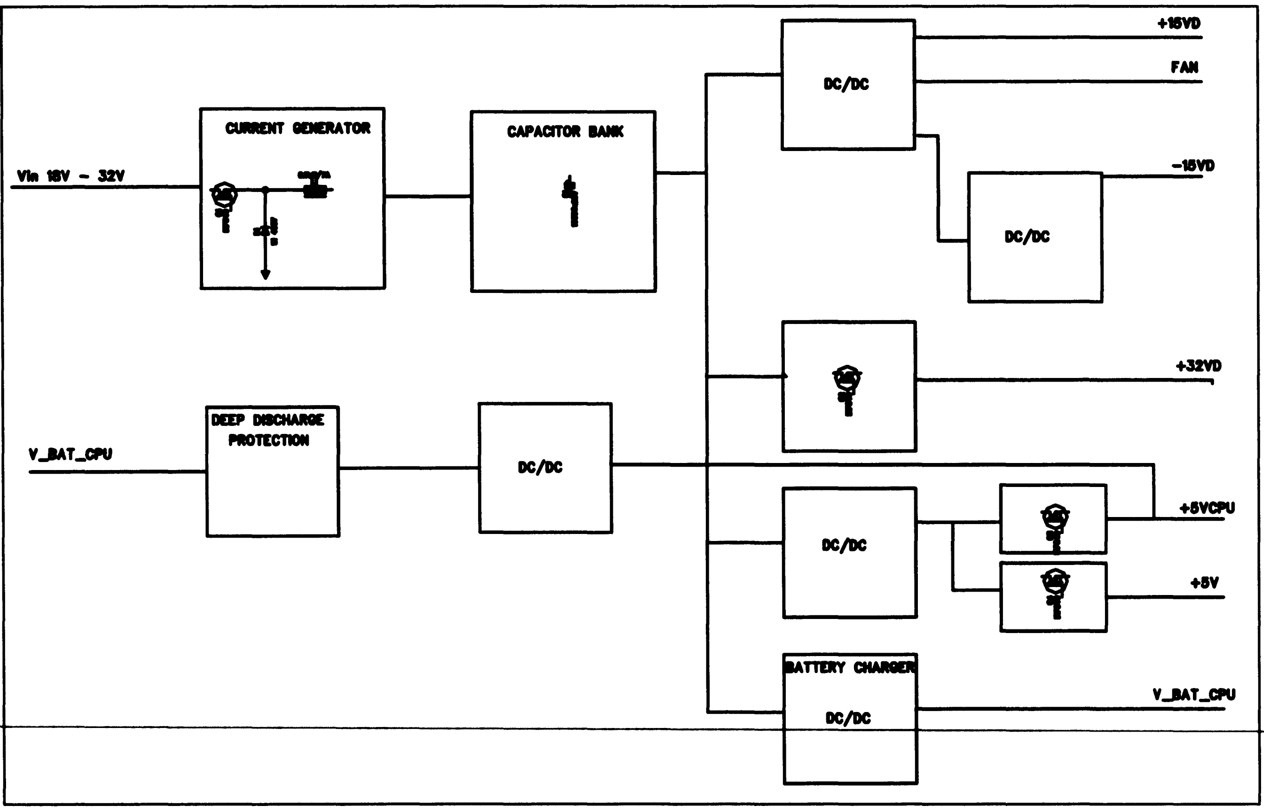
Figure 6 Central Processor Unit, F-CPU

2.3.1 DC Power board

The DC power board of the F-CPU converts the +32Vdc to voltages needed by the CPU, display controller and upinet boards and the battery. The created voltages are +15V, -15V, +5V and +5Vcpu. Also the +32Vdc is routed to the Central Processor electronics.

Output	+18...32V	+15Vd	+5V	+5VCPU	-15V
Tolerance	+18...32V	+/-0.5V	+/-0.1	+/-0.1V	+/-0.5V
Max. current	0.5A	1.1A	2.5A*	4A* standby load 0.6A	0.02A

* The maximum output current for +5V and +5Vcpu together is 4A.



Vin 18V - 32V
CURRENT GENERATOR
CAPACITOR BANK
DC/DC
+15VD
FAN
-15VD
DC/DC
+32VD
V_BAT_CPU
DEEP DISCHARGE PROTECTION
DC/DC
DC/DC
+5VCPU
+5V
BATTERY CHARGER
DC/DC
V_BAT_CPU

Figure 7 Block diagram of the DC Power unit of F-CPU

Power logic

The power related control logic is located in the power board.

Power ON/STBY control includes logic to switch the power supply on or off by turning the ON/STBY switch. The ON/STBY line is fed by +7V (max. current 70mA). When this line is grounded (for example by the ON/STBY switch), the DC Power supply switches on.

RESET_CPU signal is transmitted to the CPU interface in case the mains voltage fails or the power is cut off. RESET signal is also generated for other digital boards.

Audio amplifier

Audio signal from the CPU is amplified and filtered for the loudspeaker. Amplification gain is about 5 dB.

Protections

The following protections generate an automatic power off situation without any message in advance.

1. High voltage protection (+32 V, +15 V, +5 V, +5 Vcpu). Requires manual start-up. Power cord must be disconnected shortly prior to the start-up.
2. Low voltage protection (+32 V). Automatic power off when U < +25 V. Automatic start-up after voltage is back to normal.
3. High current protection (all secondary outputs). Output restrained until cause is eliminated.
4. High temperature protection. Automatic power off at +58 °C (approx.) and automatic start-up at +48 °C (approx.).

Over temperature protection

Over temperature possible caused by a fan failure, the fan filter is not clean or the power supply unit is overloaded. If the temperature inside the F-CPU frame exceeds +58°C, the unit is shut down. There is automatic recovery when the temperature decreases to +48°C. The temperature is measured at the DC Power board.

Audible alarm for power fail

There is an option for audible alarm at power fail. This function is enabled by a switch. When the +32V on the DC power board decreases lower than +5V, a 700Hz oscillator is switched on for 15 sec.

Service reset button

The service reset button at the back plate of the DC Power board is for service purpose. Press this button with an appropriate tool for at least five seconds before you remove any PC board or the Power supply unit from the rear of the Central Processing Unit.

NOTE: Before connecting the power cord back and starting to monitor, be sure that at least one minute has passed after the service reset button was pressed. Too short a time may lead to a memory flaw.

2.3.2 External components

Fan

The fan is switched on automatically when +32 Vd is generated.

Loudspeaker

The loudspeaker is controlled by the audio-amplifier on the DC Power board.

Battery

6 V, 1.2 Ah sealed lead-acid battery is used to supply power to the CPU board after the power is turned off and the power cord is disconnected.

The maximum discharge current of the battery is 1A. Charging voltage of the battery is between 5.5V and 6.8V, the max charge current is 0.1A.

The battery is protected with a 2A fuse.

2.3.3 CPU mother board

The CPU mother board connects the CPU board and other boards, functioning as a bus between them.

There are connectors for five PC boards. Four of those are normally occupied by B-UPI4NET, B-CPU5, B-DISPX and DC Power Board (takes the place of two slots) and one is reserved for a second Display Controller Board, B-DISPX.

The bus structure is the same as in all S/5 monitors.

ON/STBY line is connected only to the Display controller board's connector from where it goes directly to the Keyboard and ON/STBY switch.

2.3.4 Connectors

There are three connectors at the back of the DC Power board: one for connecting the N-AC power unit with F-CPU power cable and two for connecting the F-CU5(P) with F-CPU Signal cable.

The F-CPU Signal cable includes both power and signal (module bus) lines.

There is a DIS (Device Interfacing Solution) connector at the front of the F-CPU.

2.4 5-Module Frame, F-CU5(P)

The 5-Module Frame, F-CU5 or F-CU5P has five single width module slots for parameter modules. It includes a Module Mother board, and its own DC power board.

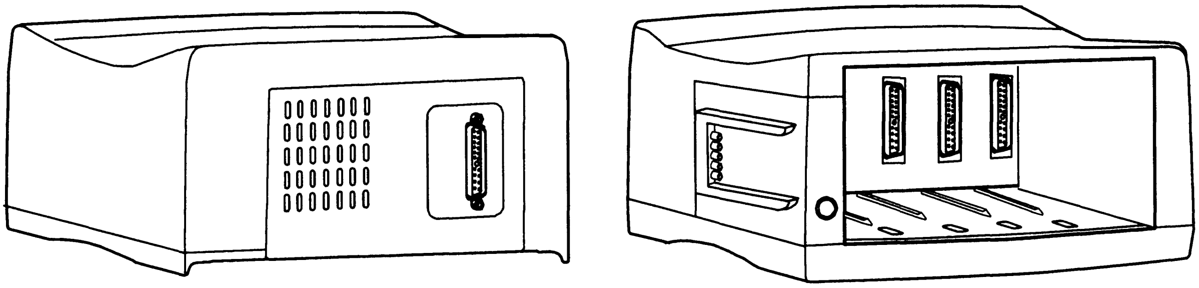


Figure 8 **5-Module Frame F-CU5P, back and front view**

2.4.1 DC Power board

The DC Power board is located at the back of the F-CU5(P) frame. The DC Power board converts the +32Vdc that is fed through the F-CPU DC Power board, to voltages needed by the frame electronics and the parameter modules. The created voltages are +15Vd, +15V, -15V and +5V. Also +32V is routed through.

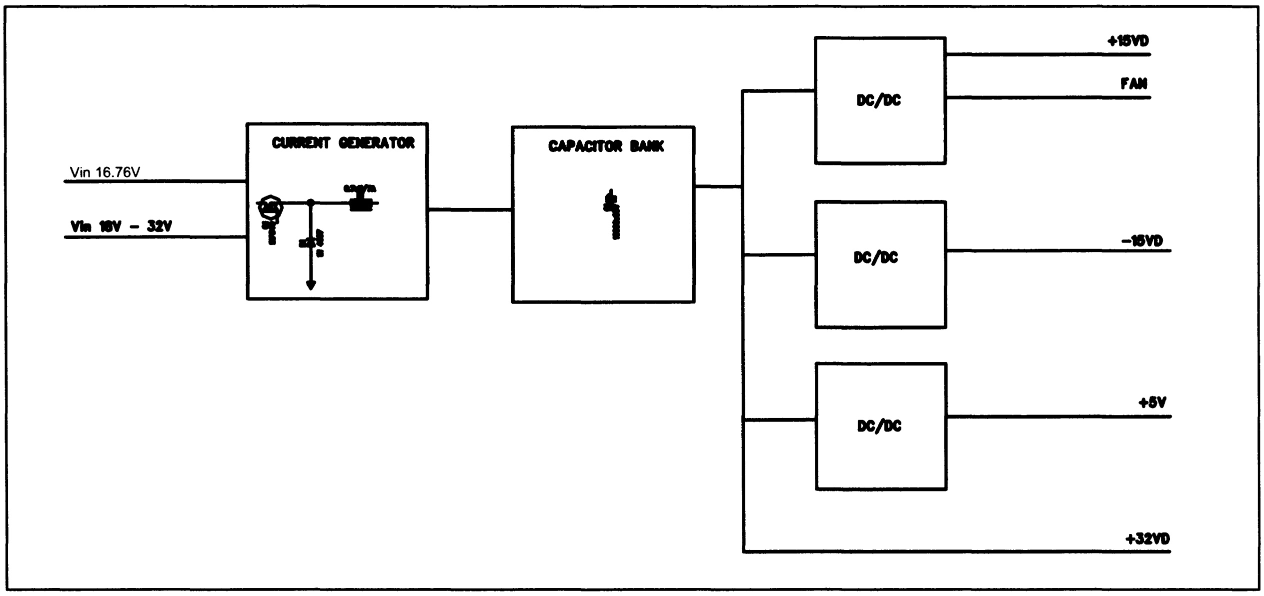

CURRENT GENERATOR
CAPACITOR BANK
Vin 16.76V
Vin 18V - 32V
DC/DC
DC/DC
DC/DC
+15VD
FAN
-15VD
+5V
+32VD

Figure 9 Block diagram of the DC Power board of the F-CU5(P)

Output	+18...32V	+15Vd	+15Va	+5V	-15V
Tolerance	+18...32V	+/-0.5V	+/-0.1	+/-0.1V	+/-0.5V
Max. current	0.5A	2.5A	0.1A	1.5A	0.1A

Flex boards

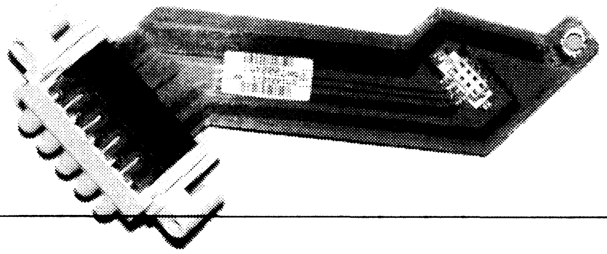


Figure 10 Modulebus Flex board

The connector for E-PSM(P) is located on the modulebus flexboard in F-CU5P.

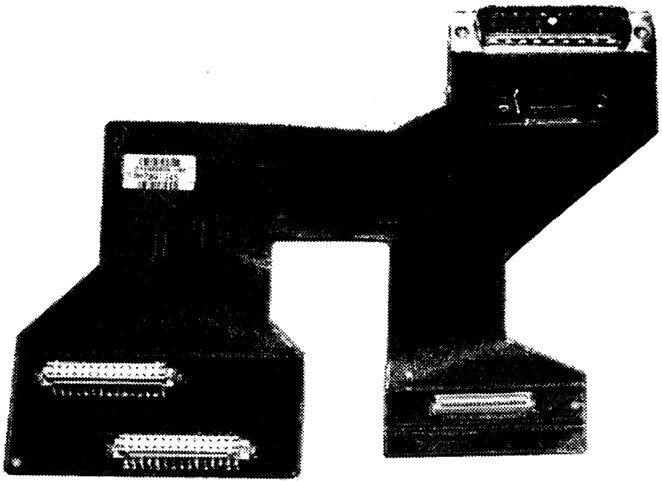


Figure 11 Interconnection Flex board

There are connectors on the interconnection board to connect the modulebus flexboard, the CPU board, the module mother board and the F-CPU (external connector).

2.5 External connectors and signals

2.5.1 5-Module Frame, F-CU5(P)

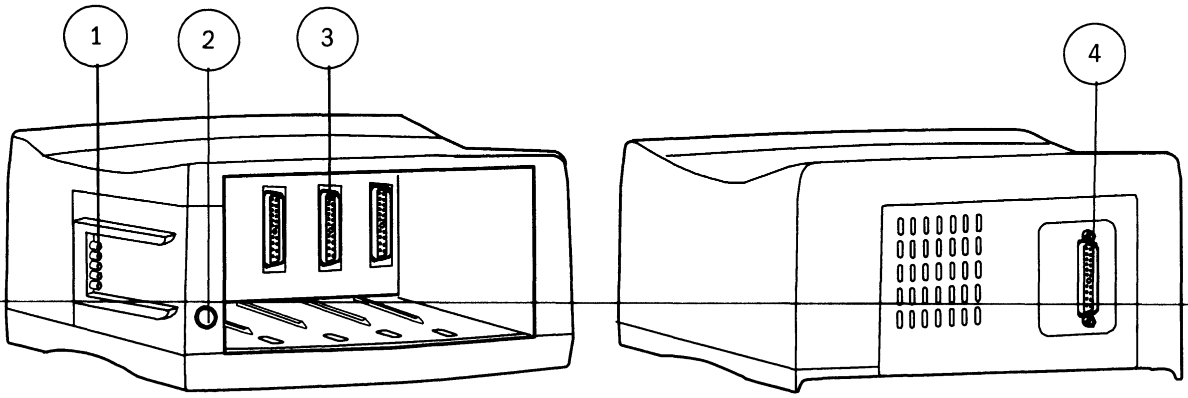


Figure 12 External connections, F-CU5(P)

(1) Connector for E-PSM module

(2) Synchronisation connector

(3) Module connector

(4) Connector for Central Processor Unit, F-CPU

Table 1 Module connector for E-PSM, F-CU5P

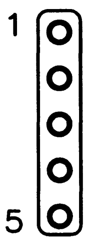
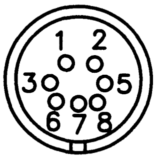
5 pin female connector	Pin	Signal
	1	GND
	2	Vmod 13.8 - 16 V
	3	Data +
	4	Data -
	5	Shield

Table 2 Synchronization connector, F-CU5(P)

Mini DIN7 connector	Pin	Signal
	1	Defib_sync_out
	2	Reserved
	3	Analog GND
	5	Digital GND
	6	GND
	7	Pressure_out
	8	Direct_ECG_out

Defibrillation Sync (pin1)

Digital defibrillator output synchronization signal. Defibrillation Sync indication is generated by ECG. When active, the signal is in state 1. After 10 ms the signal is reset to state 0. Defibrillation Sync is not generated before the indication is deactivated. The delay from the R wave peak to the start of the signal is maximally 35 ms.

Pressure out (pin 7):

- P1 from hemodynamic module

The Invasive pressure output signal is 1 V/100 mmHg, originally ranging from 0 to 320 mmHg, and with a delay of approximately 25 ms. The signal requires an input impedance of 100 k.

Direct ECG (pin 8):

Delay (max.):	15 ms
Gain ECG (out)/ECG (in):	1 V/1 mV
Pacer:	5 V and 2 ms pulse

Table 3 Module connector out (X1-X4), F-CPU(P)

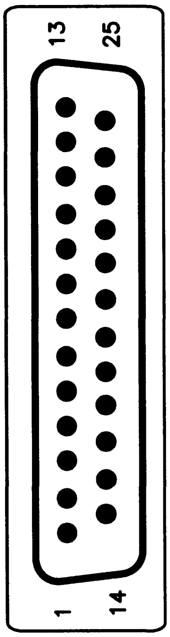
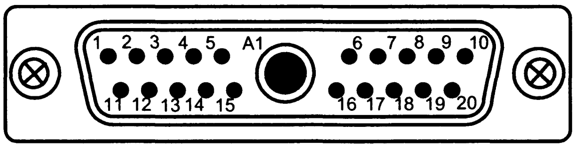
25 pin male D-connector	Pin	Signal
	1	Reset_485
	2	-15V
	3	15Vdirty
	4	+15V
	5	Data_485_
	6	Data_485
	7	GND
	8	Reset_485_
	9	CTSB
	10	RTSB
	11	RXDB
	12	TXDB
	13	GND
	14	NC
	15	GND
	16	CTSC
	17	RTSC
	18	RXDC
	19	TXDC
	20	NC
	21	PWM_ECG
	22	RXD_RS232
	23	TXD_RS232
	24	+5V
	25	+5V

Table 4 Connector for Central Processor Unit F-CPU in F-CU5(P)

		
Connector: 21W1xxx male	**Pin**	**Signal**
	A1	GND
	1	RESET_RS485 (Module reset +)
	2	-RESET_RS485 (Module reset -)
	3	DIR_ECG
	4	DEF_SYNC
	5	+32V (power output)
	6	ECG_PWM
	7	TXDC (TXD_to_MEM)
	8	RXDC (RXD_from_MEM)
	9	RTSC (RTS_to_MEM)
	10	CTSC (CTS_from_MEM)
	11	DATA_RS485 (Module data +)
	12	-DATA_RS485 (Module data -)
	13	IBP1
	14	+32Vd (power output)
	15	+32Vd (power output)
	16	ENABLE Enable power, GND, short pin
	17	TXDB (TXD_to_REC)
	18	RXDB (RXD_from_REC)
	19	RTSB (RTS_to_REC)
	20	CTSB (CTS_from_REC)
	Shield	Cable shield, GND

2.5.2 Power Unit, N-AC and Central Unit, F-CPU

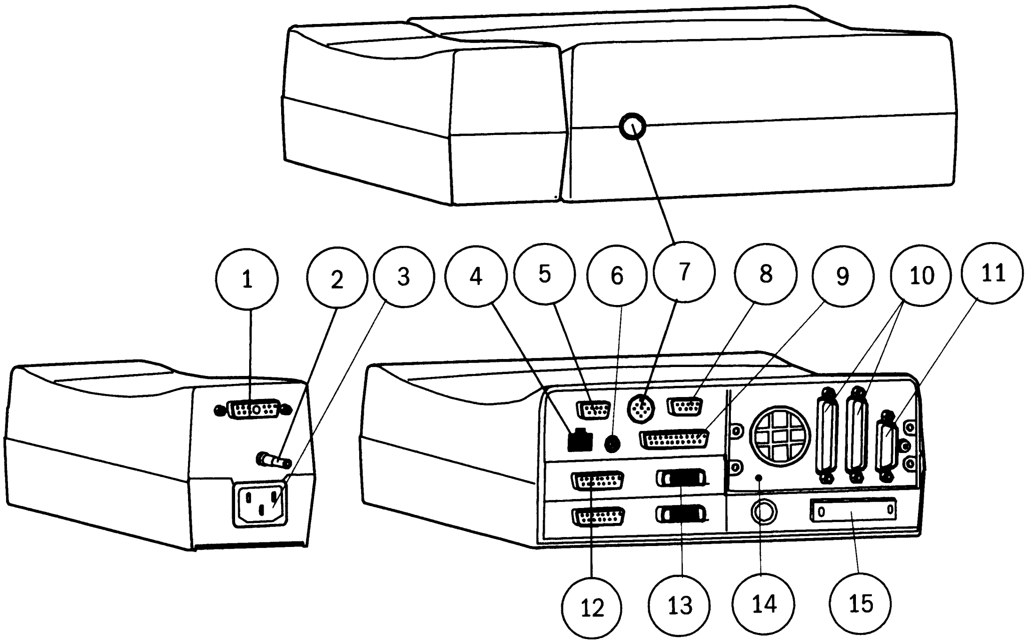


Figure 13 External connections, N-AC and F-CPU

(1) Connector for Central Processor Unit, F-CPU
(2) Equipotential connector
(3) Receptacle for power cord
(4) Network connector (B-UPI4NET)
(5) Identification plug (B-UPI4NET)
(6) Direct ECG output (B-UPI4NET)
(7) Connector for the S/5 Device Interfacing Solution, DIS (B-UPI4NET)
(8) RS-232 output (B-UPI4NET)
(9) Parallel printer port (B-UPI4NET)
(10) Connectors for two F-CU5(P) 5-Module Frames
(11) Connector for Power Unit, N-AC
(12) Connectors for Command Bar, Remote Controller, anesthesia record keeping solution keyboard and 12” LCD display, D-LCC12 (B-DISPX)
(13) Display connectors DVI (B-DISPX)
(14) Service reset button
(15) Software card slot (B-CPU5)

NOTE: For a more detailed description of the connectors, please see the following slots in this manual: the “CPU Board, B-CPU5” slot, the “UPINET Board, B-UPI4NET” slot and the “Displays and Display Controllers” slot about Display Controller Board, B-DISPX.

F-CU5 Power Unit, N-AC

Table 5 DC +32V output connector, N-AC

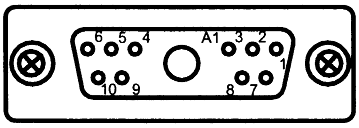
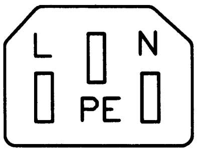
Connector: 11W1xxx female	**Pin**	**Signal**
	A1	GND
	1	GND
	2	ENABLE Enable power, GND, short pin in cable
	3	NC
	4	+32V
	5	+32V
	6	+32V
	7	+32V
	8	+32V
	9	NC
	10	GND
	Shield	Cable shield, GND, metal case

Table 6 Main power X3, N-AC

Mains connector	**Pin**	**Signal**
	L	Live
	PE	Protected earth
	N	Neutral

DC power cable

The connector types in the cable are 11W1xxx male and 11W1xxx female.
Pin numberings are the same as in +32V output connector in Table 5 and Table 7.

Central Processor Unit, F-CPU

Table 7 DC +32V input connector, F-CPU

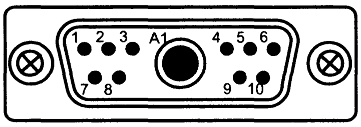
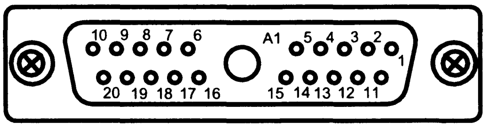
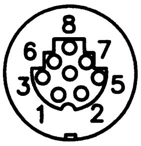
Connector: 11W1xxx	**Pin**	**Signal**
	A1	GND
	1	GND
	2	ENABLE Enable power, GND, short pin in cable
	3	STBY/ON
	4	+32V
	5	+32V
	6	+32V
	7	+32V
	8	+32V
	9	EXT_BAT_CHARGE
	10	GND
	Shield	Cable shield, GND, metal case

Table 8 Connectors to 5-Module Frame, F-CU5(P) (2 pcs) in F-CPU



Connector: 21W1xxx female	Pin	Signal
	A1	GND
	1	RESET_RS485 (Module reset +)
	2	-RESET_RS485 (Module reset -)
	3	DIR_ECG
	4	DEF_SYNC
	5	+32V (power output)
	6	ECG_PWM
	7	TXDC (TXD_to_MEM)
	8	RXDC (RXD_from_MEM)
	9	RTSC (RTS_to_MEM)
	10	CTSC (CTS_from_MEM)
	11	DATA_RS485 (Module data +)
	12	-DATA_RS485 (Module data -)
	13	IBP1
	14	+32Vd (power output)
	15	+32Vd (power output)
	16	ENABLE Enable power, GND, short pin
	17	TXDB (TXD_to_REC)
	18	RXDB (RXD_from_REC)
	19	RTSB (RTS_to_REC)
	20	CTSB (CTS_from_REC)
	Shield	Cable shield, GND

Table 9 DIS connector, F-CPU

10 pin female connector	Pin	Signal
	1	Data +
	2	Data -
	3	+15Vd
	4	GND
	5	+8V_DIS
	6	GND
	7	DATA to UP I+
	8	DATA to UP I-
	Shield	Shield in metal frame

3 Service procedures

3.1 General service information

The field service of the F-CU5 is limited to replacing the faulty printed circuit boards or mechanical parts. The printed circuit boards should be returned to Datex-Ohmeda for repair.

Datex-Ohmeda is always available for service advice. Please provide the unit serial number, full type designation, and a detailed description of the fault.

CAUTION Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.2 Service check

These instructions include complete procedures for a service check. The service check is recommended to be performed after any service repair. However, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form (APPENDIX A) which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check form should be signed after performing the procedure.

3.2.1 Recommended tools

Tool	**Order No.**	**Notes**
Command Board		
E-REC/ M-REC		
Hemodynamic Multiparameter Module		
Oscilloscope		
~~Patient Simulator~~		
Multimeter		
Screwdriver		

3.2.2 Recommended parts

Part	**Order No.**	**Notes**
Fan filter for F-CPU	M1014462	
Fan filter for F-PU5(P)	M1016473	
Recorder paper		

3.2.3 Visual inspection

Make sure that no cables or modules are connected to the Power Unit, Central Processor Unit and 5-Module Frame.

5-Module Frame, F-CU5(P)

1. Frame

   Check that the plastic frame is intact.

   ✍

2. Pads and screws

   Turn the frame onto one of its sides. Check that all the four rubber pads are in place and the screws on the bottom are tightened properly.

   ✍

3. Module motherboard connectors

   Turn the frame back to its normal position.

   Check that the module motherboard connectors are clean and intact. Check also that the screws that connect the module mother board to the frame are tightened properly.

   ✍

4. PSM connector

   W/ F-CU5P model: check that the PSM connector is clean and intact.

   ✍

5. Module motherboard position

   Check that the E-REC/M-REC fits in smoothly and locks up properly in all possible slots in the Central Unit. Leave the E-REC/M-REC disconnected.

   ✍

6. Fan filter

   Clean or replace the fan filter.

   ✍

CAUTION Ensure that the module is properly orientated (i.e. module release latch facing downward) before insertion.

Central Processor Unit, F-CPU

7. Plastic frame

   Check that the plastic frame is intact.

   ✍

8. Brass plugs

   Check that the two brass plugs on the frame are tightened properly.

   ✍

9. DIS connector

   Check that the DIS connector at the front side of the frame is clean and intact.

   ✍

10. Rubber pads and screws on the bottom

    Turn the frame onto one of its sides. Check that all the six rubber pads are in place and the screws on the bottom are tightened properly.

    ✍

11. Fan filter

    Clean or replace the fan filter.

    ✍

12. Service reset button

    Check that the service reset button is intact. Press the button for at least five seconds.

✍

PC boards

13. PC board screws

    Check that all the rear side PC boards are secured to the Central Processor Unit with screws.

    ✍

14. PC board connectors

    Check that the PC boards' rear panel connectors are clean and intact.

    ✍

15. Block screws for cables

    Check that all block screws for cables are in place and tightened properly. Check also that their threads are intact.

    ✍

16. Grounding plates

    Check that the grounding plates under the PC board rear panels are attached properly and are not bent.

    ✍

17. Display controller board jumpers/DIP switches

Disconnect the Display controller board(s) and check that the address and interruption jumpers/ DIP switches have been set correctly. The instructions for setting the jumpers can be found in the "Displays and Display Controllers" slot of the Technical Reference Manual,

Leave the board(s) disconnected.

Disconnect the UPI4(NET) board.

F-CU5 Power Unit, N-AC

18. Power unit frame

Check that the power unit frame is intact.

19. Power output connectors

Check that the power output connector is clean and intact.

20. Power inlet connector

Check that the power inlet connector is clean and intact.

21. Equipotential tap and rear panel screws

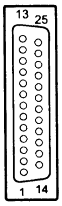
Check that the equipotential tap and all the rear panel screws are tightened properly.

3.2.4 General inspection

22. Communication lines

Measure resistance from the following Module mother board's connector pins against the ground:

Module mother board connector



Pin 1 +Reset RS485
Pin 5 -Data RS485
Pin 6 +Data RS485
Pin 8 -Reset RS485
Pin 13 Ground

Check that the resistance on each of the pins is higher than 10 kΩ. If not, replace the Module mother board.

- Reconnect the PC boards and secure them to the Central Processor Unit with screws.

- Attach the F-CPU Power cable to the N-AC and F-CPU.
- Attach the F-CPU Signal cable to the F-CPU and F-CU5(P).

NOTE: Make sure that the cables are properly attached and secured.

- Install the video display together with the Command Board, the Hemodynamic module and E-REC/M-REC. Connect the mains power cord and turn the monitor on.

✍

23. Fan

    Check that the fan is running.

    ✍

24. Starting

    Check that the monitor starts up properly, i.e. the alarm LEDs on the Command Bar turn blank, the start-up sound is heard from the loudspeaker and the normal monitoring screen appears. No error messages should appear on the screen.

    ✍

25. Module communication

    Check that the connected modules are recognized, i.e. the needed parameter information is shown on the screen and the E-REC/ M-REC records two lines of start-up information.
    If some parameter information is missing, check the screen configuration from the MONITOR SETUP menu.

    ✍

26. Real time clock

    Check that the clock on the screen shows correct time. Adjust the time, if necessary.

    Monitor Setup - ***Time And Date***

    NOTE: If the clock shows time 0:00 continuously (at successive start-ups), the SRAM/ TIMEKEEPER chip on the CPU board, or its battery, needs to be replaced.
    The FACTORY RESET should be performed after the replacement has been made.

    ✍

27. Loudspeaker sound

    Check the loudspeaker by setting the alarm sound:

    Alarms Setup - ***Alarm Volume***

    Test the whole volume scale from 1 to 10 by turning the ComWheel and check that the alarm volume changes correspondingly. The alarm sound should be clear and audible with all the settings.

    ✍

    Preset InvBP and ECG measurement settings:

Invasive Pressures - ***P3 Setup - Label - Art***

ECG - ECG1 LEAD -I

Connect a patient simulator to the Hemodynamic multiparameter module.

The settings with a Dynatech Nevada medSim 300 Patient Simulator:

SENSITIVITY switch position: 5 µV/V/mmHg

BP - 1 - WAVE - ART

ECG - BASE - BPM - 160

PACE - WAVE - NSR

28. ECG out

    Connect an oscilloscope between the signal out connector pins 8 (ECG out) and 6 (Ground). Check that an analog signal which corresponds with the ECG waveform on the screen comes out. The output signal's ratio to the actual ECG signal should be around 1V/1mV.

    ✍

29. Pressure out

    Connect the oscilloscope between the signal out connector pins 7 (Pressure out) and 6 (Ground). Check that an analog signal which corresponds with the InvBP waveform on the screen comes out. The output signal's ratio to the actual InvBP signal should be around 1V/100mmHg.

    ✍

30. Monitor software

    Enter the service menu.

    Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

    Take down the information regarding monitor software.

    ✍

31. Content of service log

    Select SERVICE LOG from the menu. Record the Service log onto the E-REC/ M-REC by selecting RECORD LOG. Check the content of recording for possible problems, then empty the Service log by selecting RESET LOG from the menu.

    ✍

32. Voltages

    Check the power supply unit output voltages through the service menu:

    Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8) - ***Frame - Power Supply***

    The output voltages should meet the following ranges:

+15V	14.20....15.60 V
-15V	-14.00...-15.50 V
+15VD	14.10.....15.60 V
+5V	4.70......5.40 V

If any of the voltages is out of the tolerance, replace the F-CPU DC Power Board.

33. Watchdog circuitry

    Test the Central Unit watchdog circuitry:

    Monitor Setup - Install/Service (password 16-4-34) - ***Service*** (password 26-23-8) - ***Set/Test - Watchdog***

    Go through the tests one by one and check that the monitor performs a restart in all other cases except when performing **WD by UPI**.

    NOTE: When selecting WD BY OVERLOAD, restarting should take place approximately after 15 seconds. With the other tests, restarting takes place within a couple of seconds.

    If restarting did not take place, try to locate the fault:

    Watchdog --> CPU board /Power supply unit

    WD by Overload --> CPU board

    WD by GSP --> Primary display controller board / CPU board

34. Trend retaining

    Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby.

    Turn the monitor to standby and disconnect the power cord. Wait for two minutes, then reconnect the power cord and turn the monitor back on. The monitor should perform a "Warm start" which means the trend information and temporary settings should still be available.

    If the monitor performed a "Cold start" instead, the battery needs to be replaced.

    The information regarding the start-up is saved also in the Service log.

35. Service reset button

    Check the service reset button. Turn the monitor to standby and press the service reset button for at least five seconds. Turn the monitor back on and check that the monitor performs a "Cold start".

36. Recovering from power loss

    Disconnect the power cord (during operation) for a moment, reconnect it and check that the monitor recovers without problems. The monitor should perform a "Warm start".

    NOTE: F-CU5(P) may give an audible alarm during the power loss. The alarm is set by the DIP switch on the F-CPU DC Power Board.

37. Electrical safety check

    Perform an electrical safety check and a leakage current test.

✍

38. Functioning after electrical safety check

    Check that the Central Unit functions normally after the performed electrical safety check.

✍

39. Final cleaning

    Clean the Central Unit with suitable detergent.

✍

- Fill in all necessary documents.

3.3 5-Module Frame disassembly and reassembly

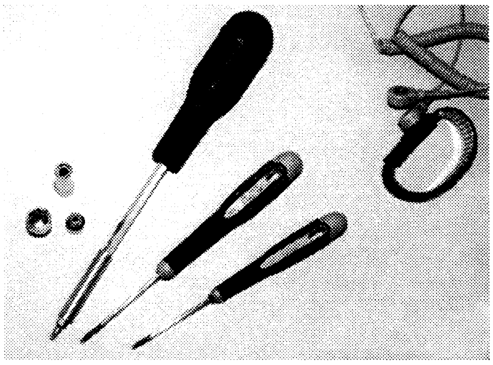
3.3.1 Before disassembly

CAUTION Perform a leakage current measurement whenever service or repair has been done on the device.

NOTE: Wear a grounded, antistatic wristband when handling PC boards. Electrostatic discharge may damage components on the board.

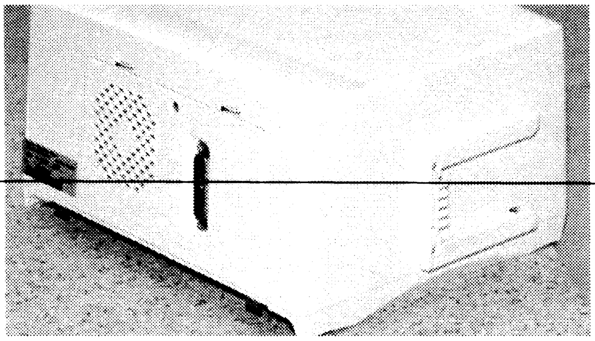
Disconnect the main power cord. If the monitor is connected to the Datex-Ohmeda Network, disconnect the Mon-Net cable.

3.3.2 Tools needed

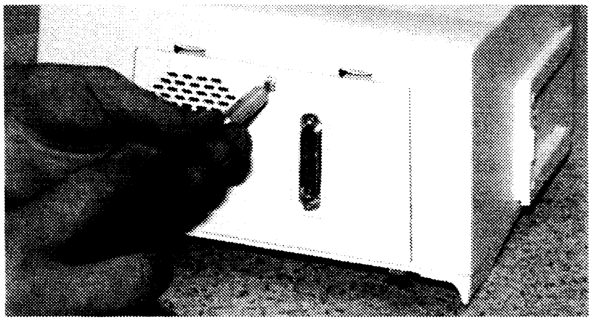


- screwdriver, TORX; T6, T10, T20
- crosshead screwdriver; P21
- flat blade screwdriver
- antistatic wristband

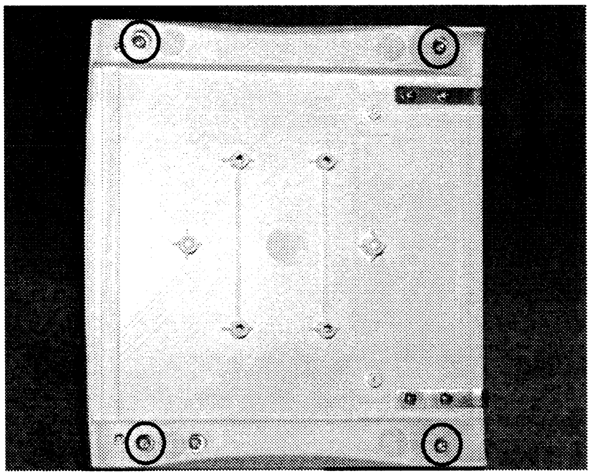
3.3.3 To disassemble the 5-Module Frame, F-CU5(P)



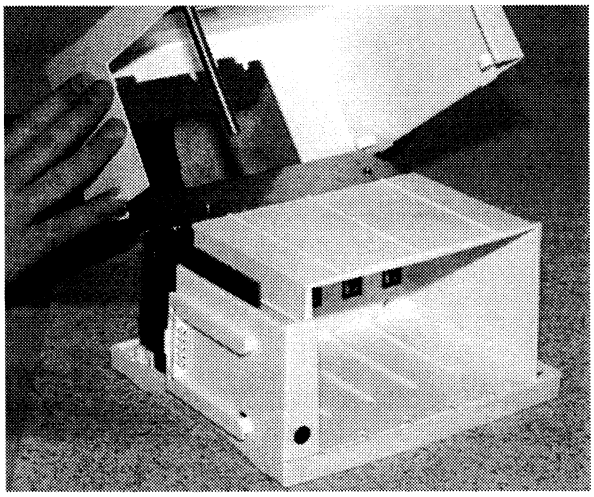
1. Remove all the cables from the F-CU5(P).



2. Remove the screw (P21) to open the back cover (including fan filter). Press the locking clamps to remove the back cover.

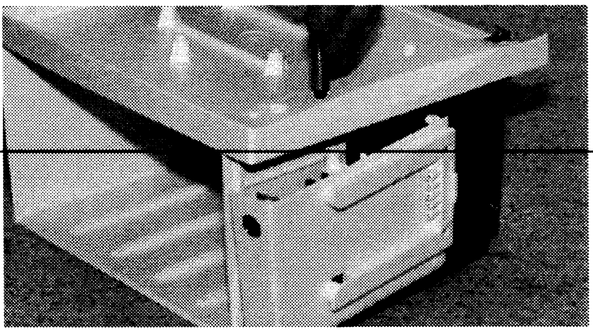


3. Remove the four screws (T20) at the bottom of the F-CU5(P) frame.

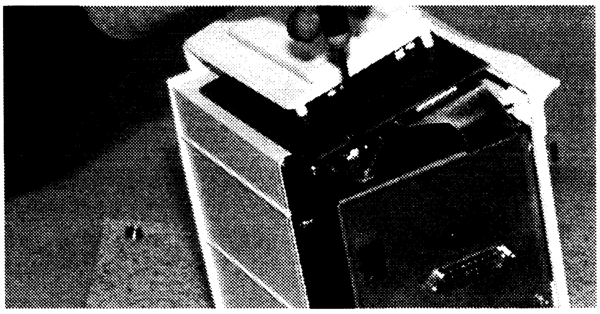


4. Remove the cover of the frame.

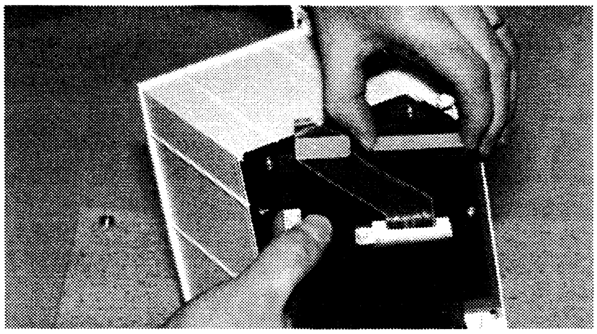
To remove the PSM Connection Unit



1. Remove the screw (T20) holding the PSM Connecting Unit.

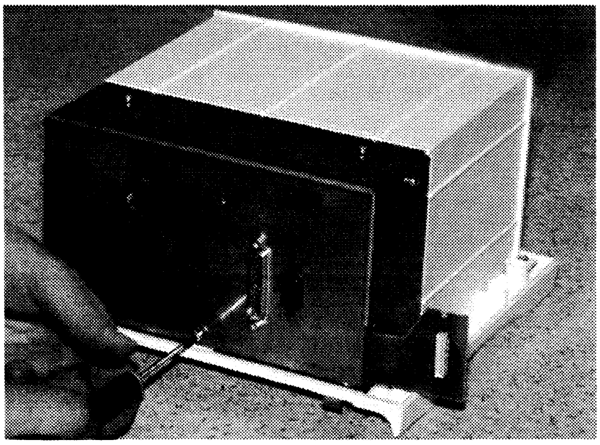


2. Remove the two screws (T10) to remove the sync connector.

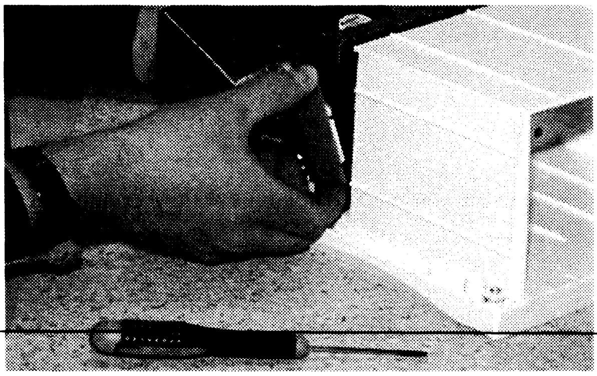


3. Remove the four screws (T10) to remove the EMBC board. Remove the PSM connector.

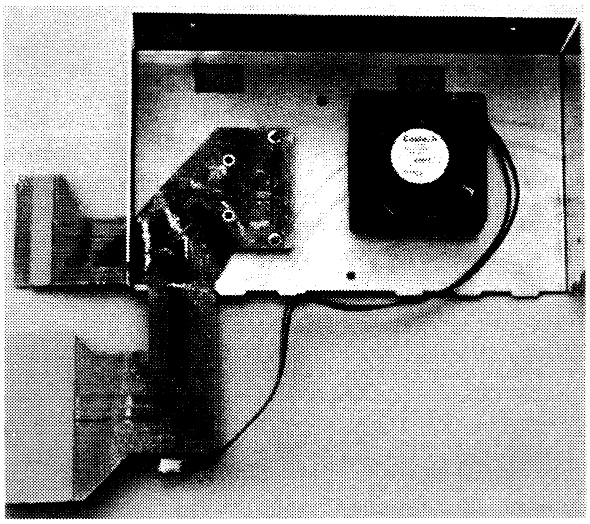
To remove the F-CU5(P) frame EMC cover and fan unit



1. Remove the PSM Connection Unit.
2. Remove the seven screws (T10) to remove the EMC cover.

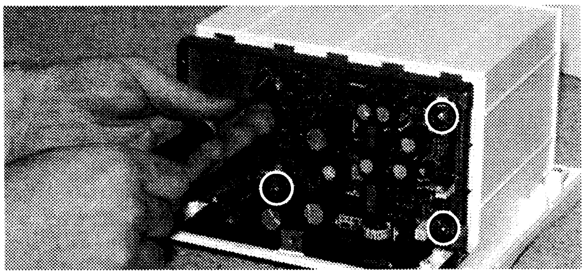


3. Detach the connector connecting the power board and module mother board together.
4. Disconnect the fan cable from the power board.



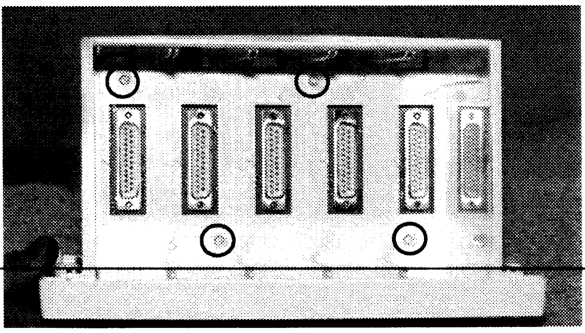
5. Now you can access the following field replaceable parts:
- Frame unit fan
- EMC cover
- Connection flex board

To remove the F-CU5(P) frame power board

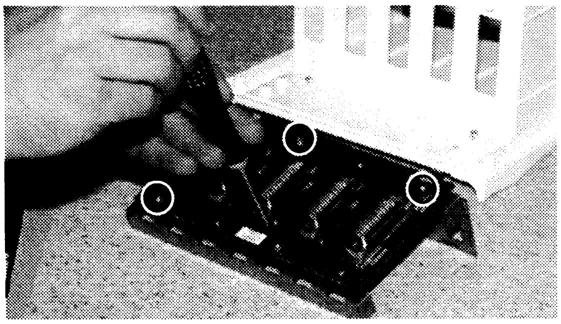


1. Remove the F-CU5(P) frame fan unit.
2. Remove the four screws (T10).

To remove the module mother board

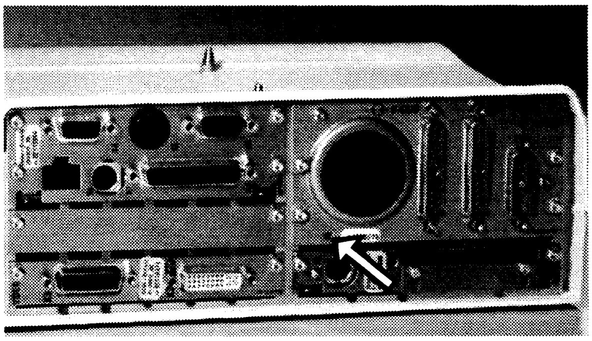


1. Remove the EMC cover from the frame. It is not necessary to remove the F-CU5(P) frame power board.
2. Face the frame module side towards you.
3. Remove the four screws (T10) holding the board and its supporting plate.

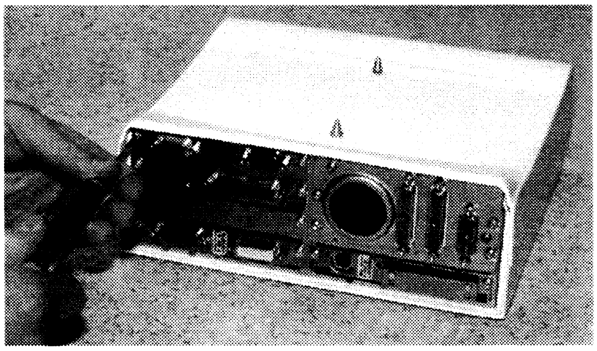


4. Remove the four screws (T10) to detach the mother board from the supporting plate.

3.3.4 Central Processing Unit, F-CPU

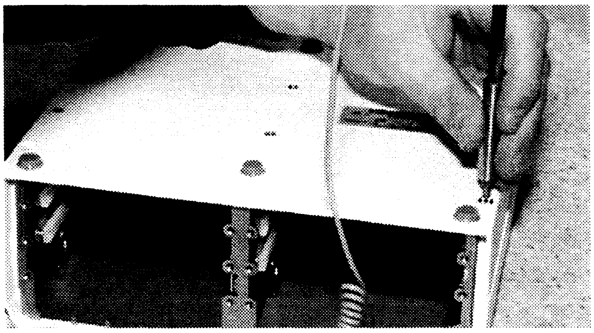


1. Press the service reset button with an appropriate tool for at least five seconds before removing any PC board or the Power supply unit from the rear of the Central Processing Unit, F-CPU.

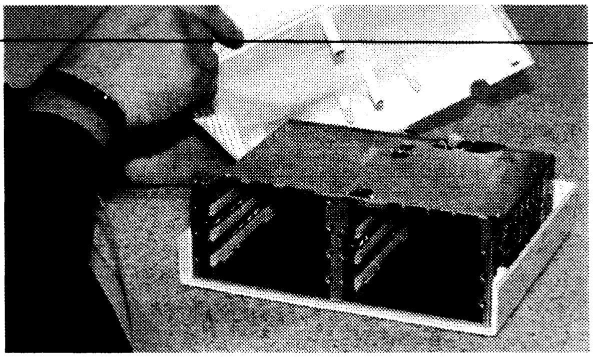


2. Remove the following boards from the back of the F-CPU.

- B-UPI4NET
- B-DISPX (one or two pcs)
- B-CPU5
- F-CPU power board
- Plates covering possible empty slots

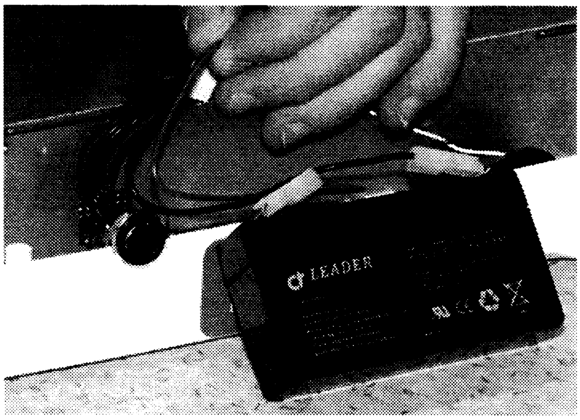


- Remove the six screws from the bottom of the F-CPU.



- You can now detach the F-CPU upper cover.

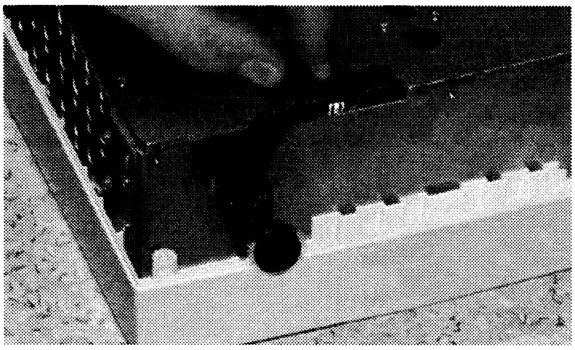
To remove the battery and the loudspeaker



1. Detach the battery cable.
2. Lift the battery from its place.
3. Detach the loudspeaker cable.
4. Lift the loudspeaker from its place.

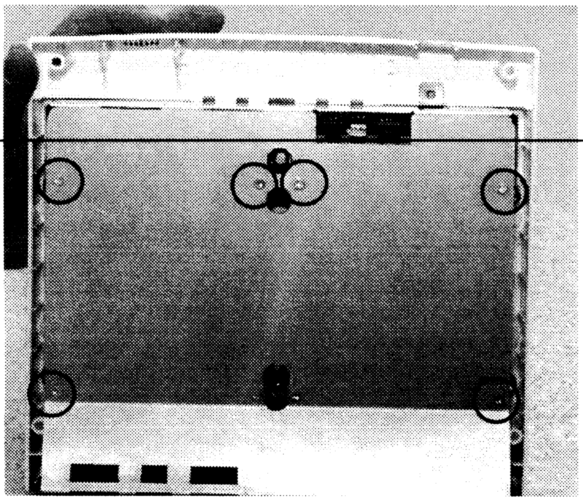
   NOTE: When reassembling the loudspeaker, place it carefully to the mounting slots.

To detach the DIS Connector Unit



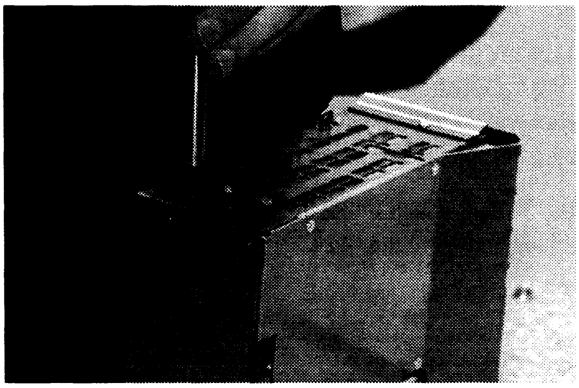
1. Remove the screw (T10) holding the DIS Unit.
2. Detach the DIS Unit cable from the CPU mother board.
3. Lift the DIS unit to remove it.

To remove the F-CPU bottom cover



1. Remove the battery and the loudspeaker.
2. Detach the DIS Connector Unit.
3. Remove the six screws (T10) and lift the EMC cover (with CPU mother board) from the bottom cover.

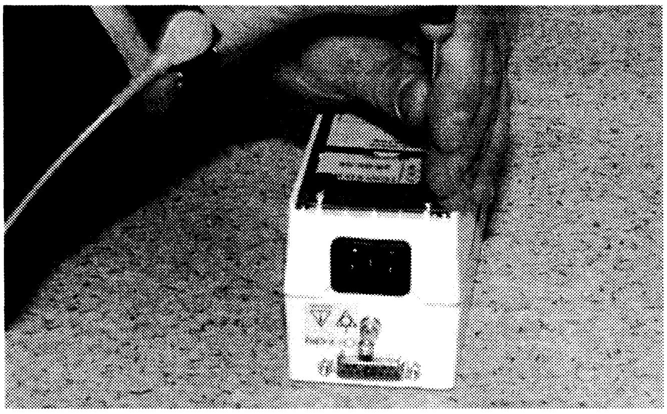
To remove the CPU mother board



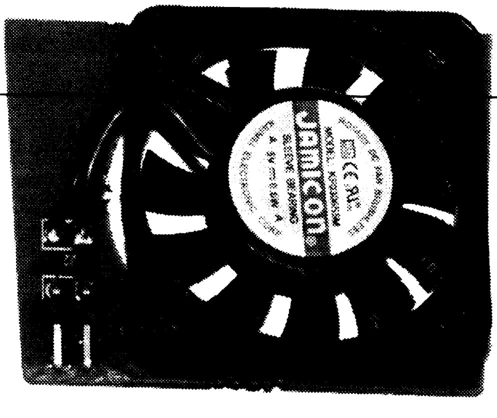
1. Remove the F-CPU bottom cover.
2. Detach the four screws holding the back plate with the CPU mother board.
3. Detach the CPU mother board from the back plate.

3.3.5 Power Unit N-AC

To reassemble and replace the fan unit



1. Turn the Power Unit upside down.
2. Remove the five TORX screws (T10).



3. Remove the two TORX (T10) screws to detach the fan unit.

Reassemble the device in reverse order.

When reinstalling make sure the cables connecting the units together are properly connected and secured.

4 Troubleshooting

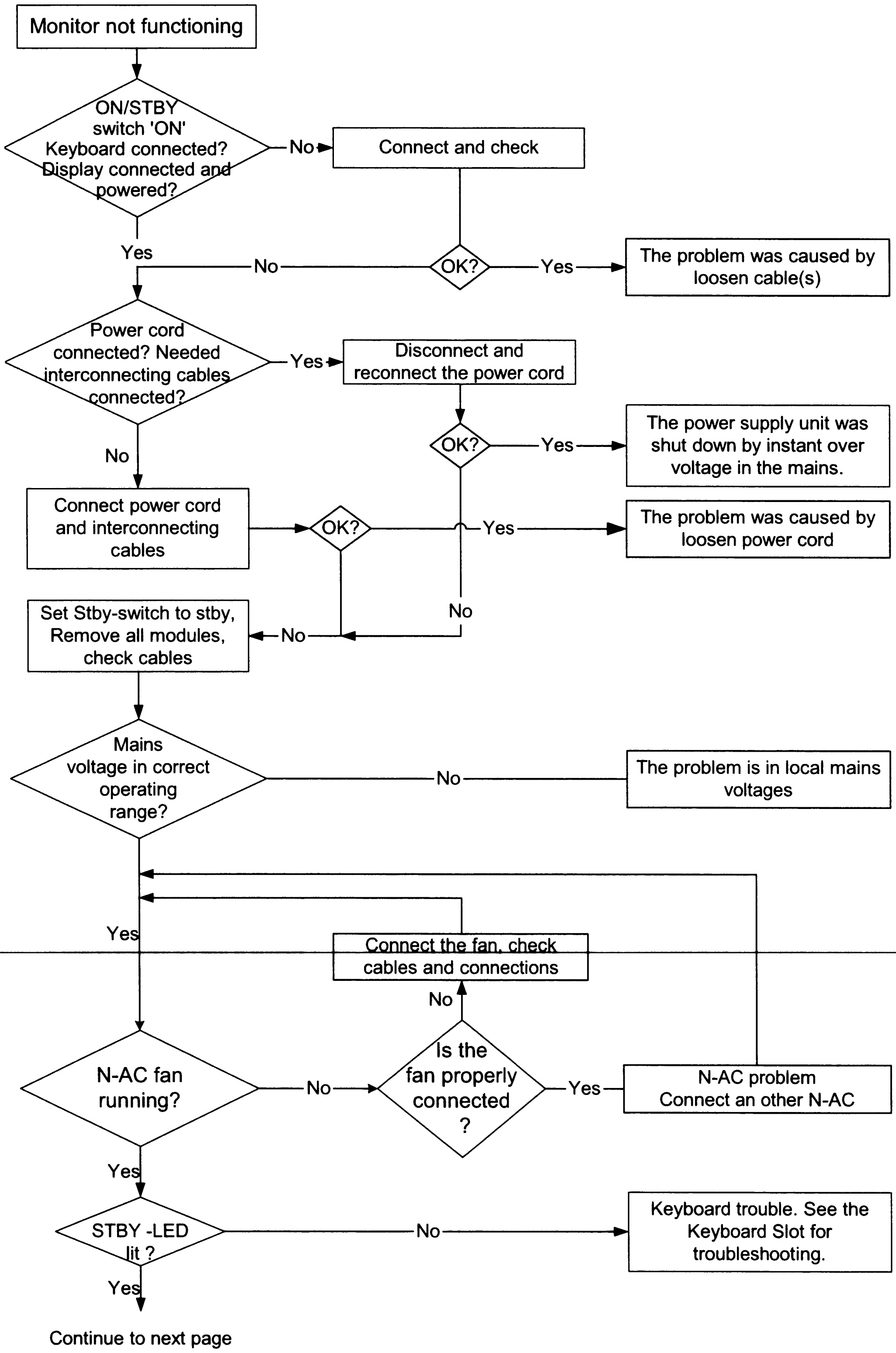

Monitor not functioning
ON/STBY switch 'ON' Keyboard connected? Display connected and powered?
No
Connect and check
Yes
No
OK?
Yes
The problem was caused by loosen cable(s)
Power cord connected? Needed interconnecting cables connected?
Yes
Disconnect and reconnect the power cord
OK?
Yes
The power supply unit was shut down by instant over voltage in the mains.
No
Connect power cord and interconnecting cables
OK?
Yes
The problem was caused by loosen power cord
No
Set Stby-switch to stby, Remove all modules, check cables
No
Mains voltage in correct operating range?
No
The problem is in local mains voltages
Yes
Connect the fan, check cables and connections
No
N-AC fan running?
No
Is the fan properly connected ?
Yes
N-AC problem Connect an other N-AC
Yes
STBY -LED lit ?
No
Keyboard trouble. See the Keyboard Slot for troubleshooting.
Yes
Continue to next page
f-cu5_trbl_frameslot1.vsd

Figure 14 Monitor troubleshooting flowchart, page 1

Continues from previous page

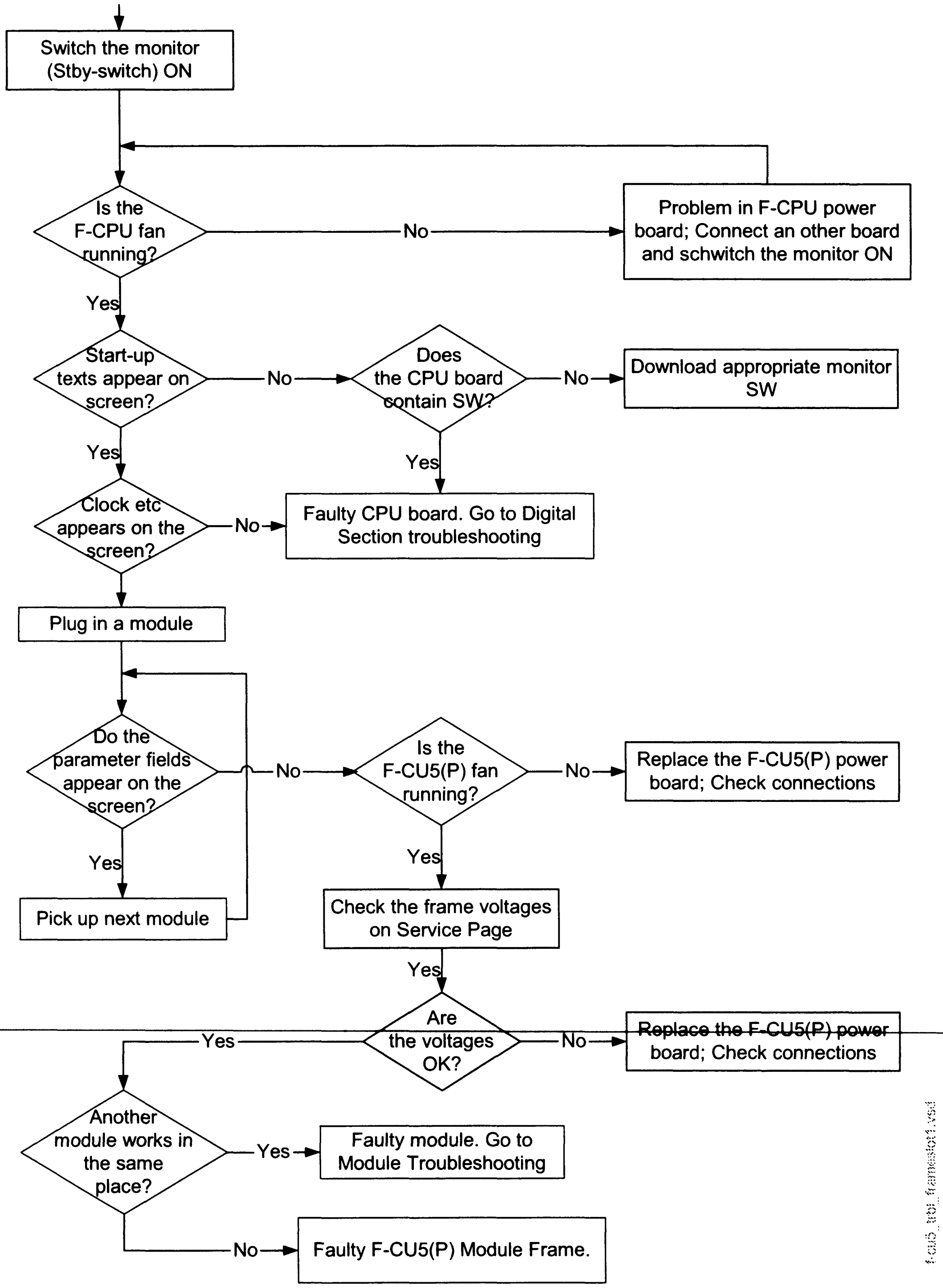

Switch the monitor (Stby-switch) ON
Is the F-CPU fan running?
No
Problem in F-CPU power board; Connect an other board and schwitch the monitor ON
Yes
Start-up texts appear on screen?
No
Does the CPU board contain SW?
No
Download appropriate monitor SW
Yes
Yes
Faulty CPU board. Go to Digital Section troubleshooting
Clock etc appears on the screen?
No
Plug in a module
Do the parameter fields appear on the screen?
No
Is the F-CU5(P) fan running?
No
Replace the F-CU5(P) power board; Check connections
Yes
Yes
Pick up next module
Check the frame voltages on Service Page
Yes
Are the voltages OK?
Yes
No
Replace the F-CU5(P) power board; Check connections
Another module works in the same place?
Yes
Faulty module. Go to Module Troubleshooting
No
Faulty F-CU5(P) Module Frame.
f-cu5_trbl_frameslot1.vsd

Figure 15 Monitor troubleshooting, page 2

4.1 Digital section

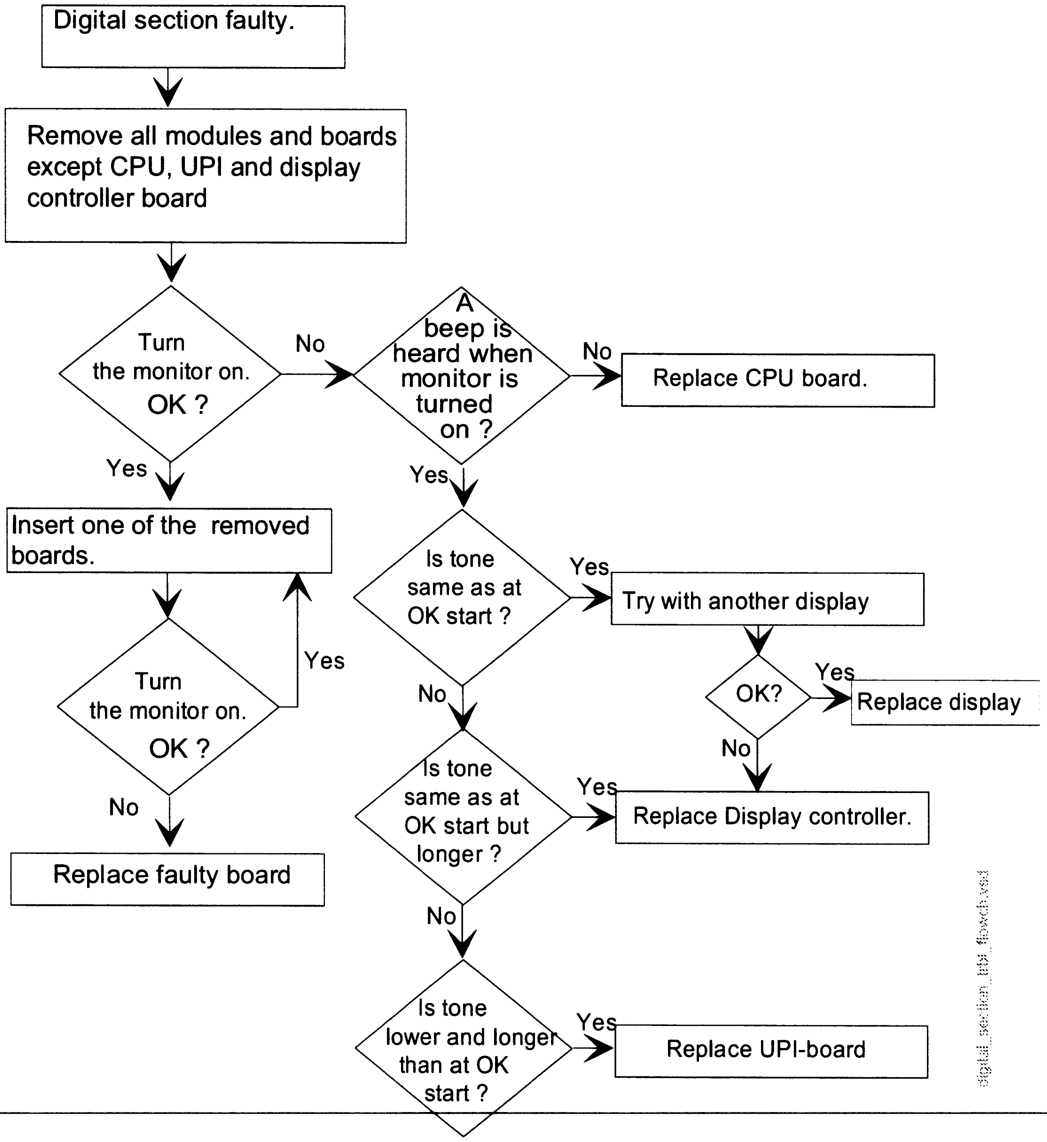

Digital section faulty.
Remove all modules and boards except CPU, UPI and display controller board
Turn the monitor on. OK ?
No
A beep is heard when monitor is turned on ?
No
Replace CPU board.
Yes
Yes
Insert one of the removed boards.
Is tone same as at OK start ?
Yes
Try with another display
Turn the monitor on. OK ?
Yes
No
OK?
Yes
Replace display
No
Is tone same as at OK start but longer ?
Yes
Replace Display controller.
No
Replace faulty board
No
Is tone lower and longer than at OK start ?
Yes
Replace UPI-board
digital_section_trbl_flowch.vsd

Figure 16 **Digital section troubleshooting flowchart**

APPENDIX A Service check form
Datex-Ohmeda 5-Module Frame, F-CU5

Customer		
Service	Module type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

. 5-Module Frame, F-CU5(P)	**OK**	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
1. Frame	☐	☐	☐	2. Pads and screws	☐	☐	☐
3. Module motherboard connectors	☐	☐	☐	4. PSM connector	☐	☐	☐
5. Module motherboard position	☐	☐	☐	6. Fan filter	☐	☐	☐
. Central Processor Unit, F-CPU							
7. Plastic frame	☐	☐	☐	8. Brass plugs	☐	☐	☐
9. DIS connector	☐	☐	☐	10. Rubber pads and screws on the bottom	☐	☐	☐
11. Fan filter	☐	☐	☐	12. Service reset button	☐	☐	☐
PC boards							
13. PC board screws	☐	☐	☐	14. PC board connectors	☐	☐	☐
15. Block screws for cables	☐	☐	☐	16. Grounding plates	☐	☐	☐
17. Display controller board jumpers/DIP switches	☐	☐	☐				
. F-CU5 Power Unit, N-AC							
18. Power unit frame	☐	☐	☐	19. Power output connectors	☐	☐	☐
20. Power inlet connector	☐	☐	☐	21. Equipotential tap and rear panel screws	☐	☐	☐
Notes							

General							
22. Communication lines							
+Reset RS485 (pin 1))					>10 Ω		
-Data RS485 (pin 5))					>10 Ω		
+Data RS485 (pin 6)					>10 Ω		
-Reset RS485 (pin 8)					>10 Ω		
	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
23. Fan	☐	☐	☐	24. Starting	☐	☐	☐
25. Module communication	☐	☐	☐	26. Real time clock	☐	☐	☐
27. Loudspeaker sound	☐	☐	☐	28. ECG out	☐	☐	☐
29. Pressure out	☐	☐	☐	30. Monitor software	L-		
31. Content of service log	☐	☐	☐				
32. Voltages							
+15 V					14.20...15.60 V		
-15 V					-14.00...-15.50 V		
+15 VD)					14.10...15.60 V		
+5 V					4.70...5.40 V		
	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
33. Watchdog circuitry	☐	☐	☐	34. Trend retaining	☐	☐	☐
35. Service reset button	☐	☐	☐	36. Recovering from power loss	☐	☐	☐
37. Electrical safety check	☐	☐	☐	38. Functioning after electrical safety check	☐	☐	☐
39. Final cleaning	☐	☐	☐				
Notes							

Used spare parts			

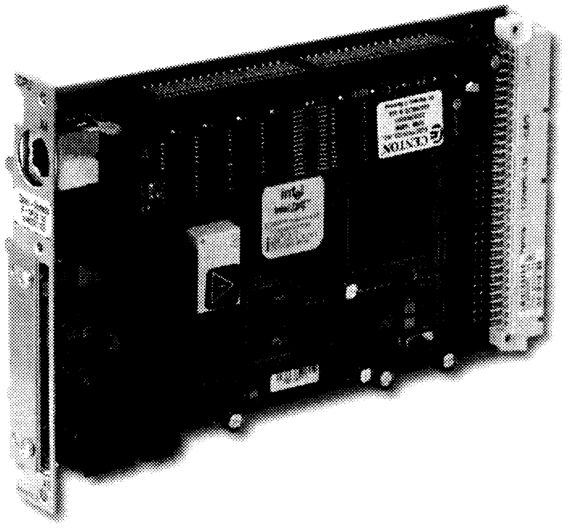
Signature

Datex-Ohmeda

$S/5^{TM}$ CPU Boards and Software Licenses

B-CPU5 (Rev.00) and B-CPU4 (Rev.01)

Technical Reference Manual Slot



All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

M1027812
May, 2005

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Introduction

This section provides information for the maintenance and service of the following products:

- CPU board, B-CPU5
- CPU board, B-CPU4
- Software Licences, U-xxxxxx/L-xxxxxxS/S-xxxxxS

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

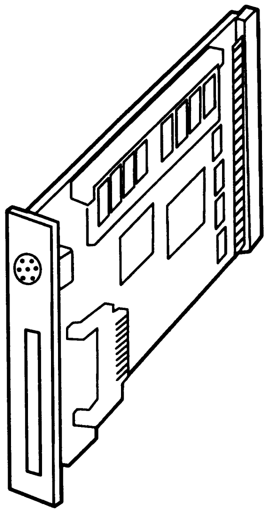


Figure 1 **B-CPU5 / B-CPU4**

1 Specifications

1.1 Electrical requirements

Interruptibility	Data memory and alarm settings are saved during power failures up to 15 minutes

1.2 Environmental requirements

Operating temperature	10...35 °C / 50...95 °F
Storage temperature	-10...+50 °C / 14...122 °F
Atmospheric pressure	660...1060 hPa (660...1060 mbar)
Humidity	10...90% non-condensing

2 Functional description

2.1 CPU board, B-CPU5/B-CPU4

The CPU board takes care of the central processing.

The main features of the CPU board are:

- AMD 486DX4 or 486DX5 processor
- Internal clock frequency 75 MHz

Memory capacity	**B-CPU5**	**B-CPU4**
• DRAM	32 MB	16 MB
• program flash memory	64 MB	32 MB

- 8 kB static RAM with real time clock
- 32 kB EEPROM memory

- 2 + 2 channels UART:
  - 3 serial channels with signals in AC-logic level
  - 1 serial channel signals in RS232-level
- Programmable alarm sound generator
- PC-card slot for software updates

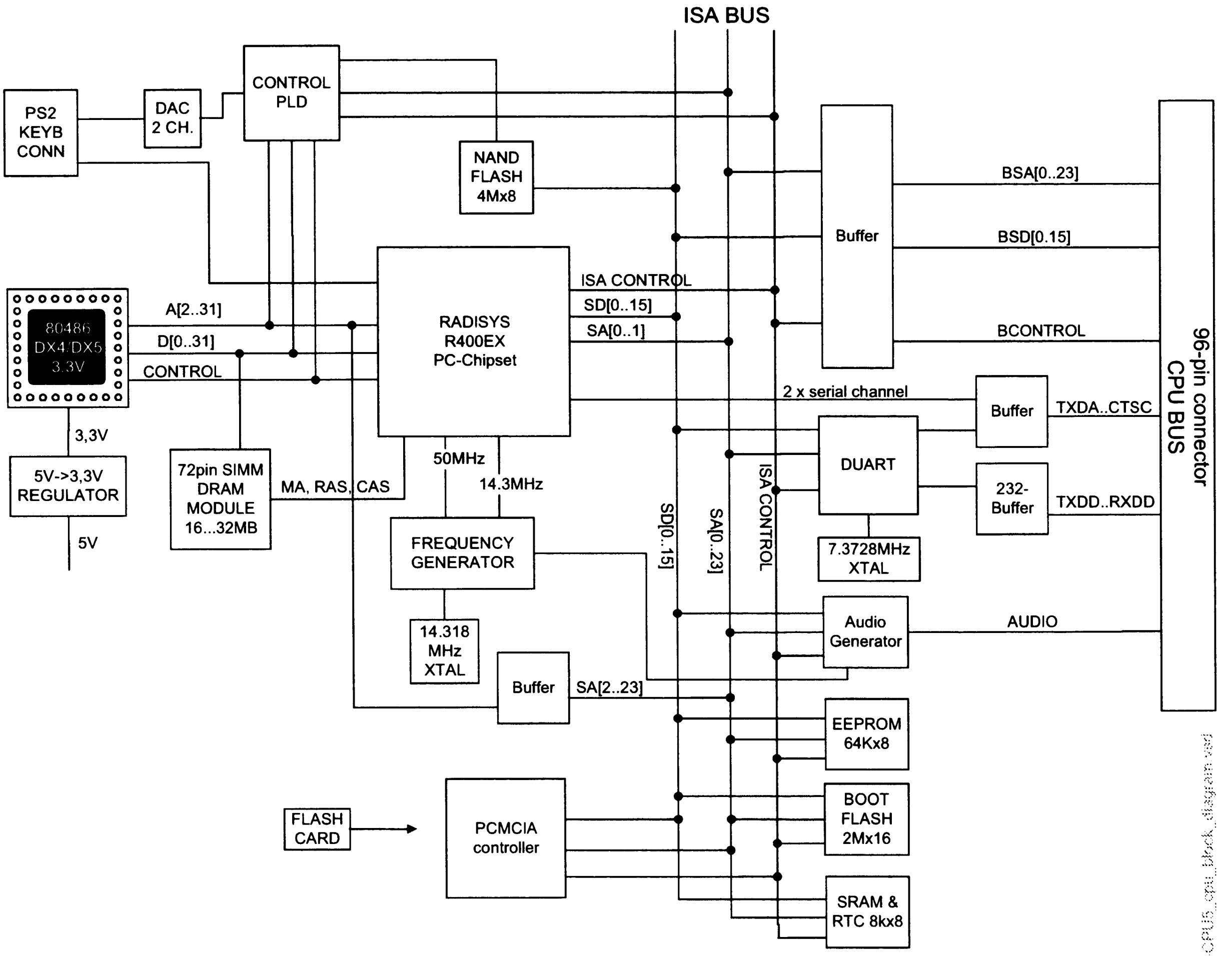

ISA BUS
PS2 KEYB CONN
DAC 2 CH.
CONTROL PLD
NAND FLASH 4Mx8
Buffer
BSA[0..23]
BSD[0.15]
BCONTROL
96-pin connector CPU BUS
80486 DX4/DX5 3.3V
A[2..31]
D[0..31]
CONTROL
RADISYS R400EX PC-Chipset
ISA CONTROL
SD[0..15]
SA[0..1]
2 x serial channel
Buffer
TXDA..CTSC
232-Buffer
TXDD..RXDD
DUART
7.3728MHz XTAL
3,3V
5V->3,3V REGULATOR
5V
72pin SIMM DRAM MODULE 16...32MB
MA, RAS, CAS
50MHz
14.3MHz
FREQUENCY GENERATOR
14.318 MHz XTAL
Buffer
SA[2..23]
SD[0..15]
SA[0..23]
ISA CONTROL
Audio Generator
AUDIO
EEPROM 64Kx8
FLASH CARD
PCMCIA controller
BOOT FLASH 2Mx16
SRAM & RTC 8kx8

Figure 2 CPU board block diagram, B-CPU5/B-CPU4

The CPU board, B-CPU5/B-CPU4 is made with PC-technology components. Radisys chipset and PLD handle all timings and signaling for ISA type CPU bus.

The B-CPU5/B-CPU4 contains an onboard flash memory where software is downloaded from a software card.

2.1.1 Powerfail or standby

When the monitor is turned to standby or the mains voltage fails, NMI-interrupt is generated by the power control logic. The interrupt signal in the CPU means that all supply voltages except +5V for the CPU board will be switched off shortly. NMI interrupt service program then saves all necessary parameters in the static RAM before supply voltages fail.

When hardware detects HALT command generated from power down; all the outputs to the CPU motherboard are left floating in high impedance state. Only DRAM refreshing cycle continues to occur. The halt state will continue until a RESET pulse from the power control logic circuit is received.

2.1.2 Watchdog functions

There are certain watchdog functions to ensure the monitor's performance. The UPI4(NET) board and the primary display controller board interrupt the CPU board continuously in order to state that they function properly. The CPU board refreshes the watchdog timer in the power supply unit in order to prevent reset pulse. If the primary display controller board or the CPU board stops the refreshment, the monitor will be reset in order to prevent false information to be displayed on the screen. If the UPI4(NET) board stops the refreshment, the board will be reset internally.

2.1.3 SRAM M48T18

The SRAM with a real-time clock is backed up by a lithium battery.

⚠

CAUTION The IC contains a lithium battery. Discard the battery according to local regulations.

2.2 Software License, U-xxxxxx/L-xxxxxxS/S-xxxxxS

Upgrade License, U-xxxxxx and Service License, L-xxxxxxS/S-xxxxxS is delivered on an 8 MB/4 MB PCMCIA flash memory card.

The upgrade software has been developed for monitor software upgrades. The upgrade software can be downloaded onto a monitor that is equipped with the B-CPU5/B-CPU4.
The service software has been developed to replace the original monitor software in case of a B-CPU5/B-CPU4 failure. The service software is downloaded onto a replacement empty B-CPU5/B-CPU4, *see section* "Downloading/replacing software on CPU Board, B-CPU5/B-CPU4."

There is service software available for each S/5 monitor software version. The functionality of the service software is equal to the functionality of the corresponding original S/5 monitor software.

The Service License, L-xxxxxxS and Upgrade License, U-xxxxxx is license software. The license agreement that is delivered with the software should be archived in a secure location. Relevant license number may have to be referred when contacting GE Healthcare for service/support. The licence number is needed also for possible software upgrades.

CAUTION The software card is not write-protected. For safety reasons do not use software cards in any other purposes, or on any other platforms than they are designed for.

NOTE: U-ANE03(A)/L-ANE03(A)S or later and U-ICU03(A)/L-ICU03(A) or later can be downloaded only to a monitor that is equipped with B-CPU5.

2.3 Connectors and signals

2.3.1 Internal connectors

Table 1 CPU board - CPU mother board

	A	B	C
1	+15 V	AGND	DGND
2	-15 V	BALE	DGND
3	SA0	SA1	DGND
4	SA2	SA3	RESET_RS485
5	SA4	SA5	-RESET_RS485
6	SA6	SA7	DATA_RS485
7	SA8	SA9	-DATA_RS485
8	SA10	SA11	TXDD_RS232
9	SA12	SA13	RXDD_RS232
10	SA14	SA15	PWM_ECG
11	SA16	SA17	BIT1IN
12	SA18	SA19	TXDC
13	SA20	SA21	RXDC
14	SA22	SA23	RTSC
15	-SMEMR	-SMEMW	CTSC
16	-SIOR	-SIOW	TXDB
17	CLK	-RESET	RXDB
18	-IOCHRDY	IRQ10	RTSB
19	N/C_1	IRQ11	CTSB
20	N/C_2	IRQ12	TXDA
21	-SBHE	IRQ15	RXDA
22	SD0	SD1	RTSA
23	SD2	SD3	CTSA
24	SD4	SD5	AUDIO_OUT
25	SD6	SD7	+5 V
26	SD8	SD9	+5 V
27	SD10	SD11	+5 V
28	SD12	SD13	+5 V
29	SD14	SD15	ON/STBY
30	+15 VD	-RESET_CPU	+5 V_CPU
31	+15 VD	+32 VD	REFRESH_WD
32	GNDD	GNDD	POWER_FAIL

3 Service procedures

3.1 General service information

The field service of the B-CPU5/B-CPU4 is limited to replacing the actual CPU board, the SRAM/ Timekeeper battery, or mechanical parts. Faulty CPU boards and used service software cards can be returned to GE Healthcare for repair/exchange.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation and a detailed description of the fault.

CAUTION Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.2 Service check

These instructions include complete procedures for a service check. The service should be performed after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A") which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check form should be signed after performing the procedure.

3.2.1 Recommended tools

Tool	Order No.	Notes
Command Bar / Command Board		
E-REC/M-REC		
Hemodynamic parameter module		
Screwdriver		

Visual inspection

Make sure that no cables or modules are connected to the Central Unit. Lift off the video display with its stand, if placed on the Central Unit, F-CU8.

CPU board

1. Device plates

   Check that the CPU board rear panel is clean and intact. Check that both CPU and software device plates are intact.

   ✍

2. Grounding plate

   Check that the grounding plate under the CPU board rear panel is attached properly and is not bent.

   ✍

3. SPRAM/Timekeeper battery

   The SRAM/Timekeeper battery on the CPU board is recommend to be replaced after every 8 years. Replace the battery, if necessary.

NOTE: The Factory Reset must be performed, if the SRAM/Timekeeper battery is replaced.

   ✍

4. PC board screws

   Check that all the rear side PC boards are secured to the Central Unit with two screws.

   ✍

3.2.2 Functional inspection

5. Fan

   Install the video display together with the Command Bar/Command Board, hemodynamic parameter module and the E-REC/ M-REC. Connect the power cord and turn the monitor on. Check that the fan is running.

   ✍

6. Starting

   Check that the monitor starts up properly, i.e. the alarm LEDs on the Command Bar/Command Board turn blank, the start-up sound is heard from the loudspeaker and the normal monitoring screen appears. No error messages should appear on the screen.

   ✍

7. Module communication

   Check that the connected modules are recognized, i.e. the needed parameter information is shown on the screen and the E-REC/ M-REC records two lines of start-up information.

   If some parameter information is missing, check the screen configuration from the ***Monitor Setup*** menu.

   ✍

8. Real time clock

   Check that the clock on the screen shows correct time. Adjust the time, if necessary.

   Monitor Setup - ***Time And Date***

NOTE: If the clock shows time 0:00 continuously (at successive start-ups), the SRAM/TIMEKEEPER battery should be replaced. The Factory Reset must be performed after the battery is replaced.

9. Loudspeaker sound

   Check the loudspeaker volume settings by setting the alarm sound:

   Alarms Setup - ***Alarm Volume***

   Test the whole volume scale from 1 to 10 by turning the ComWheel and check that the alarm volume changes correspondingly. The alarm sound should be clear and audible with all the settings.

10. Monitor software

    Enter the service menu.
    Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)
    Take down the information regarding the monitor software.

11. Content of service log

    Select ***Service Log*** from the menu. Record the Service Log onto the E-REC/M-REC by selecting ***Record Log***. Check the content of recording for possible problems, then empty the Service Log by selecting ***Reset Log*** from the menu.

12. CPU watchdog circuitry

    Test the Central Unit watchdog circuitry:

    Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)
    - ***Set/Test***

    Select the watchdog tests one by one and check that the monitor performs a restart in all other cases except when selecting ***WD by UPI***.

NOTE: When selecting ***WD by overload***, restarting should take place approximately after 15 seconds. With the other tests restarting takes place within a couple of seconds.

If restarting did not take place, try to locate the fault:

Watchdog --> CPU board/Power supply unit

WD by Overload --> CPU board

WD by GSP --> Primary display controller board/CPU board

13. Recovering from power loss

    Check that the monitor is capable of storing the trend information and temporary settings in a short (max. 15 minutes) standby.

Turn the monitor to standby and disconnect the power cord. Wait for two minutes, then reconnect the power cord and turn the monitor back on. The monitor should perform a “Warm start” which means the trend information and temporary settings should still be available. If the monitor performed a “Cold start” instead, the battery fuse or the lead acid battery of F-CU8 should be replaced.

NOTE: The B-CPU5/B-CPU4 requires 2 Amps battery fuse (P/N 51063).

The start-up information is also saved in the Service Log.

✍

14. Electrical safety check

    Perform an electrical safety check and leakage current test.

    ✍

15. Functioning after electrical safety check

    Check that the Central Unit functions normally after the performed electrical safety check.

    ✍

- Fill in all necessary documents.

3.3 Disassembly and reassembly

NOTE: Turn the monitor to standby and press the service reset switch for at least five seconds before detaching any PC boards.

1. Remove screws and detach all PC boards and cover plates from the right side of the CPU board.
2. Remove the screws on the CPU board.
3. Detach the CPU board.

Reassembly should be made in reversed order.

NOTE: When reinstalling PC boards, push the boards carefully until they stop before fastening them with screws.

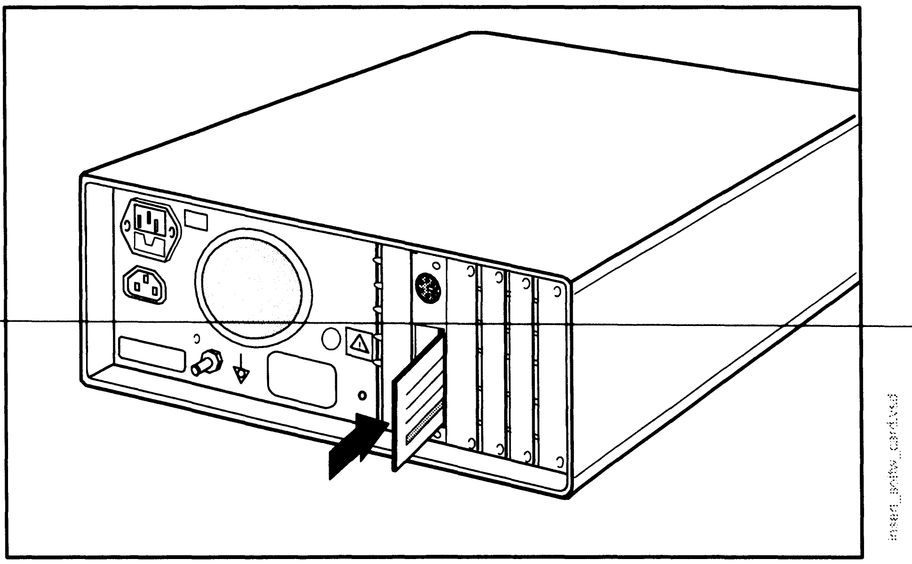
3.3.1 Downloading/replacing software on CPU Board, B-CPU5/B-CPU4

See also "Replacing CPU Board, B-CPU5/B-CPU4" on *Part I/System Installation.*

NOTE: All user settings will be lost after downloading/replacing monitor software.

NOTE: During the downloading of monitor software, the serial number of the CPU board is written onto the software card and is matched with the downloaded monitor software serial number. If the downloading of monitor software would fail, the same monitor software could be downloaded again only onto the same CPU board, but not onto any other CPU board.

1. Make sure that the monitor is turned to standby. Press and hold the service reset switch on the Central Unit rear panel for at least five seconds, or until an audible tone is generated.
2. Move off the lid for software card on the B-CPU5 / B-CPU4 rear panel.



3. Insert the software card into the card drive slot and firmly press the card in position.
4. Turn the power on.
5. Wait for approximately 80 seconds. After the start up screen appears, enter the Service View and make sure that the information regarding monitor software has been updated. Memorize the serial number of new software.

6. Remove the software card and attach the lid.
7. Pick up the software device plate with the serial number of the new software and attach the device plate on the B-CPU5/B-CPU4 rear panel.

NOTE: The license agreement, if delivered with the monitor software, needs to be in accordance with the corresponding monitor software serial number. Make sure you archive the license agreement in a secure location.

8. Perform Factory Reset.
9. Set the time and date.
10. Set the monitor's network communication according to the used network software, if necessary.

    Network -service menu:

    Network software S-CNET01 -> DRI Level = 2001
    Network software S-CNET02 -> DRI level = 2002
    Network software L-NET03 -> DRI level = 2003
    Network software L-NET05 -> DRI level = 2005

NOTE: If the DRI level is changed, the monitor will restart automatically.

11. Check that there are no error messages on the screen.
12. Restore the original user settings, if necessary.

See the troubleshooting flowchart for software card, if the downloading of new software failed.

NOTE: Right after the monitor software downloading, the start-up time is considerably longer.

3.3.2 Performing Factory Reset

NOTE: The Factory Reset is necessary after downloading of monitor software and after replacing the CPU board or SRAM/Timekeeper battery.

NOTE: The Factory Reset will restore all your customized defaults, including language selection, to factory defaults.

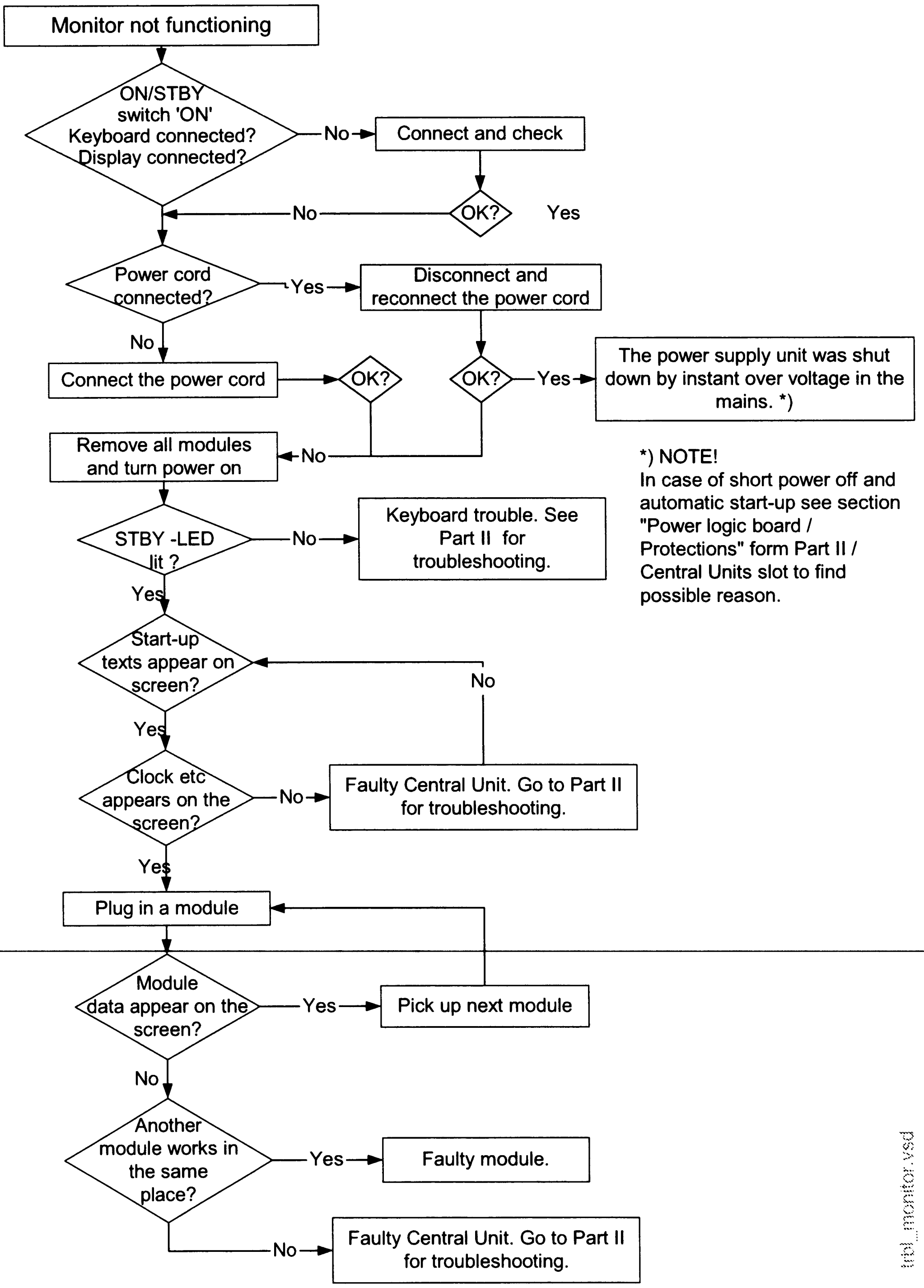
1. Press the **Monitor Setup** key.
2. Select ***Install/Service*** and password (16-4-34).
3. Select ***Service*** and password (26-23-8).
4. Select ***Set/Test*** and perform ***Factory Reset***.
5. The monitor will perform an automatic restart. After the restart is completed, restart the monitor also manually by the On/Standby switch.

3.4 Adjustments and calibrations

No calibrations or adjustments are needed on the CPU board, B-CPU5/B-CPU4.

4 Troubleshooting

4.1 Troubleshooting flowcharts


Monitor not functioning
ON/STBY switch 'ON' Keyboard connected? Display connected?
No
Connect and check
OK?
No
Yes
Power cord connected?
Yes
Disconnect and reconnect the power cord
No
Connect the power cord
OK?
OK?
Yes
The power supply unit was shut down by instant over voltage in the mains. *)
Remove all modules and turn power on
No
STBY -LED lit ?
No
Keyboard trouble. See Part II for troubleshooting.
Yes
Start-up texts appear on screen?
No
Yes
Clock etc appears on the screen?
No
Faulty Central Unit. Go to Part II for troubleshooting.
Yes
Plug in a module
Module data appear on the screen?
Yes
Pick up next module
No
Another module works in the same place?
Yes
Faulty module.
No
Faulty Central Unit. Go to Part II for troubleshooting.
trbl_monitor.vsd

*) NOTE!
In case of short power off and automatic start-up see section "Power logic board / Protections" form Part II / Central Units slot to find possible reason.

Figure 3 **Monitor troubleshooting flowchart**

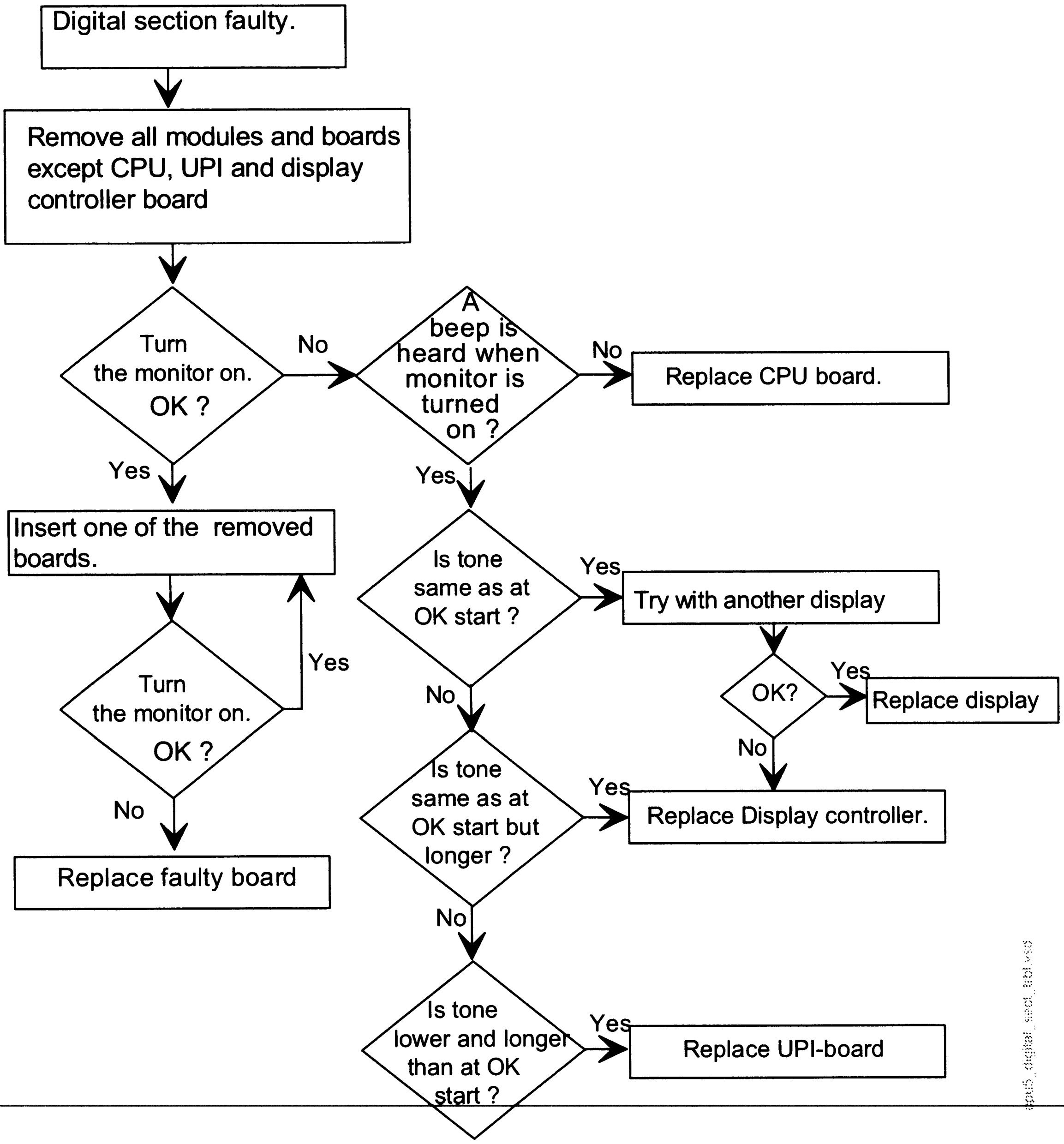
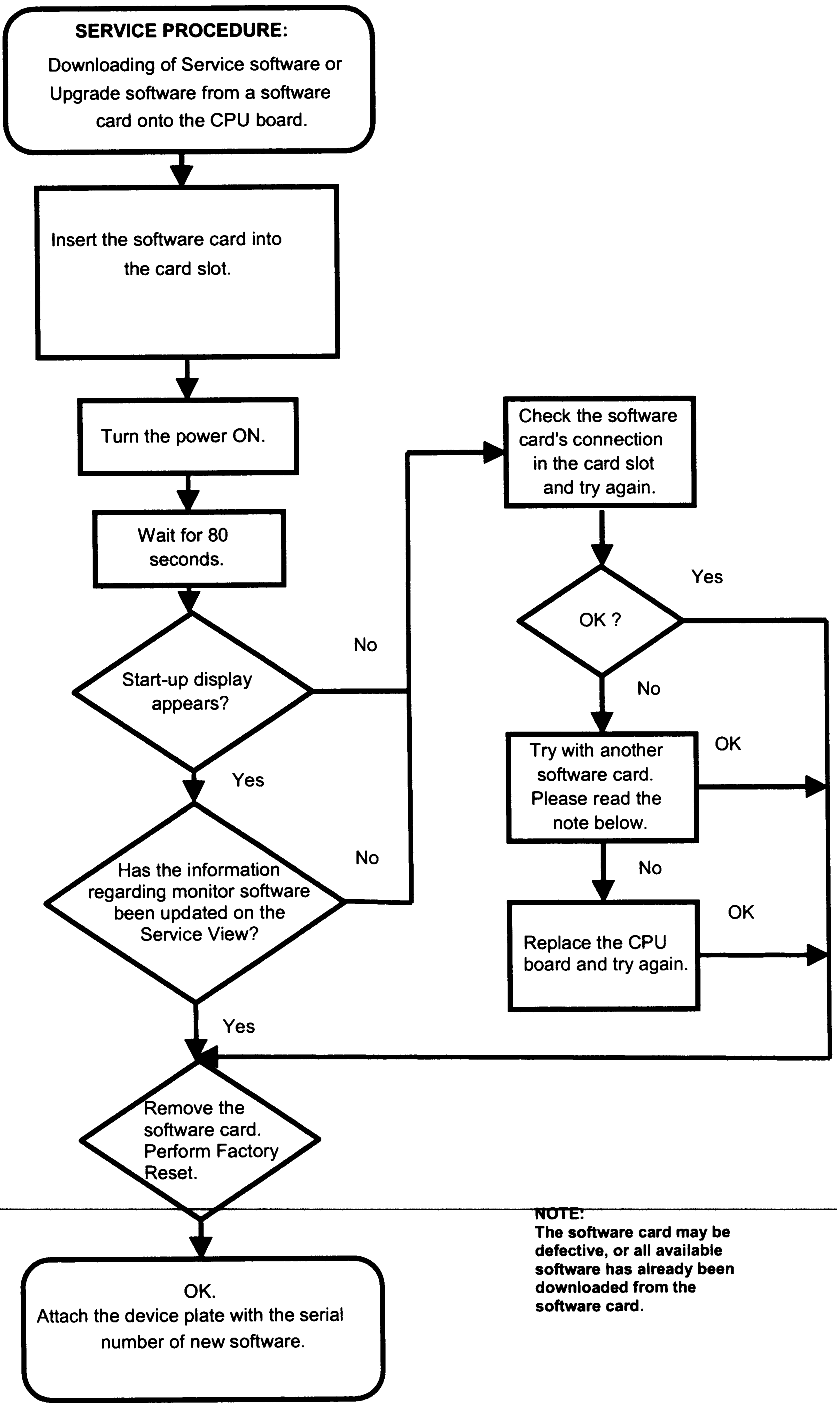

Digital section faulty.
Remove all modules and boards except CPU, UPI and display controller board
Turn the monitor on. OK ?
No
A beep is heard when monitor is turned on ?
No
Replace CPU board.
Yes
Yes
Insert one of the removed boards.
Is tone same as at OK start ?
Yes
Try with another display
Turn the monitor on. OK ?
Yes
OK?
Yes
Replace display
No
No
No
Is tone same as at OK start but longer ?
Yes
Replace Display controller.
Replace faulty board
No
Is tone lower and longer than at OK start ?
Yes
Replace UPI-board

Figure 4 **Digital section troubleshooting flowchart**


SERVICE PROCEDURE:
Downloading of Service software or Upgrade software from a software card onto the CPU board.
Insert the software card into the card slot.
Turn the power ON.
Wait for 80 seconds.
Start-up display appears?
No
Yes
Has the information regarding monitor software been updated on the Service View?
No
Yes
Check the software card's connection in the card slot and try again.
OK ?
Yes
No
Try with another software card. Please read the note below.
OK
No
Replace the CPU board and try again.
OK
Remove the software card. Perform Factory Reset.
OK.
Attach the device plate with the serial number of new software.

NOTE:
The software card may be defective, or all available software has already been downloaded from the software card.

Figure 5 Software Card troubleshooting flowchart

4.2 Error messages

4.2.1 SRAM Error

The SRAM memory is located on the CPU board. The SRAM Error is due to memory malfunction. Restart the monitor. If the problem persists, replace the SRAM/Timekeeper battery. Remember to perform factory reset after the replacement.

4.2.2 EPROM Error

The EPROM Error message is displayed due to problems in the communication between the CPU board and the software flash memory. Replace the CPU board. Remember to perform factory reset after the replacement.

4.2.3 EEPROM Error

The EEPROM memory is located on the CPU board. The EEPROM Error message is displayed due to memory malfunction. Perform factory reset. If the problem persists, replace the CPU board. Remember to perform factory reset after the replacement.

4.2.4 RAM Error

The RAM memory is located on the CPU board. The RAM Error message is displayed due to memory malfunction. Replace the CPU board. Remember to perform factory reset after the replacement.

5 Earlier revisions

This service manual fully supports earlier revisions except,

Item	**Manual and document number**
Service Menu descriptions related to software of level 97/98	Technical Reference Manual 896624 slot 895704
B-CPU2, B-CPU3	Technical Reference Manual 896624 manual slot 895704

APPENDIX A Service check form, CPU Boards

Customer		
Service	CPU board rev	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
1. Device plates	☐	☐	☐	2. Grounding plate	☐	☐	☐
3. SPRAM/Timekeeper battery	☐	☐	☐	4. PC board screws	☐	☐	☐
5. Fan	☐	☐	☐	6. Starting	☐	☐	☐
7. Module communication	☐	☐	☐	8. Real time clock	☐	☐	☐
9. Loudspeaker sound	☐	☐	☐	10. Monitor software	☐	☐	☐
11. Content of service log	☐	☐	☐				

	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
12. CPU watchdog circuitry	☐	☐	☐	13. Recovering from power loss	☐	☐	☐
14. Electrical safety check	☐	☐	☐	15. Functioning after electrical safety check	☐	☐	☐

Notes

Used spare parts			

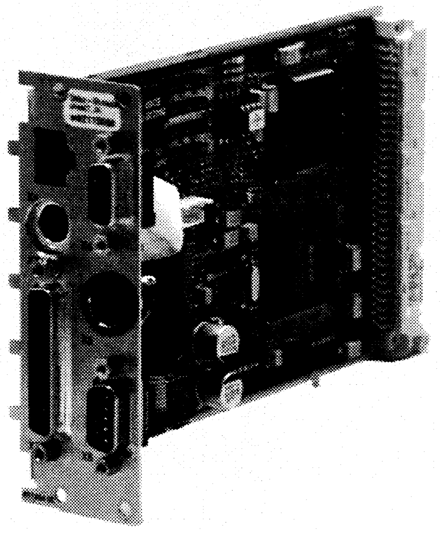
Signature

Datex-Ohmeda

S/5™ UPINET Board, B-UPI4NET (Rev.01)

UPI Board, B-UPI4 (Rev.00)

Technical Reference Manual Slot



All specifications are subject to change without notice.

CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

M1027813
May, 2005

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Appendix A: Service check form UPI4(NET) Board, B-UPI4(NET) A-1

Introduction

Datex-Ohmeda S/5 UPI4NET board, B-UPI4NET integrates the UPI board and the Network Board, B-NET. Datex-Ohmeda S/5 UPI4 board, B-UPI4 is the same board as UPI4NET except it does not contain network related components.

The UPI4NET and UPI4 boards provide interfaces for example for a computer, parallel printer and Device Interfacing Solution (DIS). In addition, the boards have two digital output signals and two analog output signals for other interfaces.

The use of UPI4NET or UPI4 board requires S/5 Anesthesia or Critical Care main software.

The service menu is described in a separate "Service Menu" slot and the spare part lists in the "AM, CCM Spare Parts" slot.

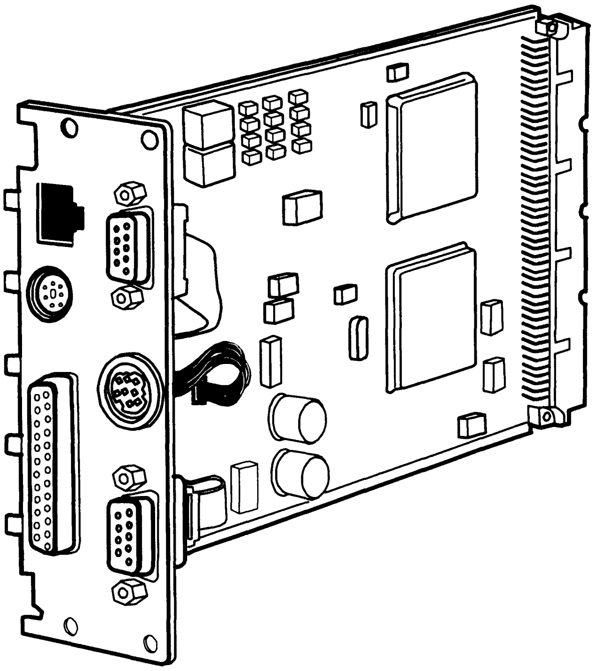


Figure 1 UPINET Board, B-UPI4NET

1 Technical specifications

1.1 General

Voltages:

- +5 V, 500 mA
- +15 VD, 50 mA + DIS power supply

Voltage and temperature measurement

1.2 UPI

Supports RS485 500 kbps module bus communication
Supports RS422 500 kbps Device Interfacing Solution (DIS) bus communication
Printer port (LPT)
RS232 level communication driven by B-CPU5/B-CPU4
Analog signals:

- Direct ECG
- Pressure Out

Digital signals:

- Defibrillation Synchronization
- Nurse Call

1.3 NET (Ethernet)

Meets IEEE802.3 specifications (10BASE-T)
Hospital grade approved data transformer
Coding element interface

2 Functional description

2.1 General

2.1.1 UPI section

The UPI section functions as a general I/O-board. It performs I/O duties assigned to it by the CPU board. The main processor in the CPU board and the processor in the UPI section communicate through a dual-port memory which is located on the UPI4(NET) board.

Functional blocks

The UPI section contains the external bus interface, a processor, program and dual-port memories and I/O-block.

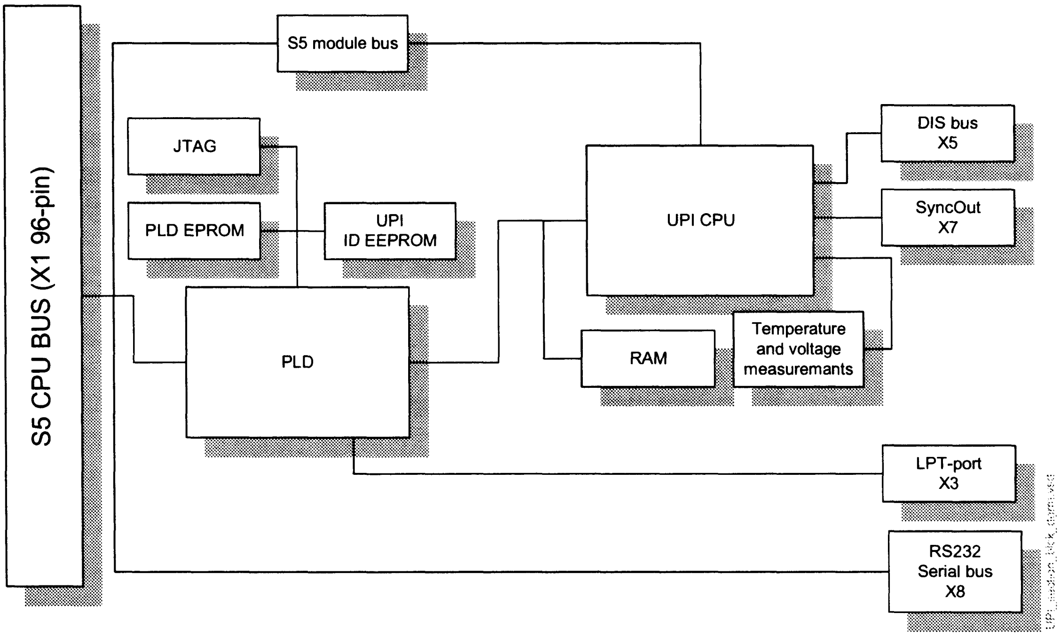

S5 CPU BUS (X1 96-pin)
S5 module bus
JTAG
PLD EPROM
UPI
ID EEPROM
PLD
UPI CPU
RAM
Temperature
and voltage
measuremants
DIS bus
X5
SyncOut
X7
LPT-port
X3
RS232
Serial bus
X8

Figure 2 **UPI section block diagram**

External bus interface

The UPI section is connected to the CPU mother board. The following signals pass on between the UPI section and CPU mother board: data bus, address bus, reset, read and write signals, and other related signals.

Processor

The processor in the UPI section is an H8S/2655, which functions at 16 MHz frequency.

RS232 serial bus interfaces

RS232 serial bus is connected to the connector X8. That serial channel is driven by the CPU board. Only the RS232 buffer and some filtering components are located in the UPI4(NET) board.

RS485 module bus interface

RS485 half-duplex communication bus for modules. Communication speed rate is 500 kbps.

RS422 DIS bus interface

RS422 full-duplex communication bus for DIS modules. Communication speed rate is 500 kbps. DIS interface includes DIS power supply that gives voltages +8 V (max 1A) and +15 VD (max 1A).

2.1.2 NET section

The NET section is illustrated in a block diagram shown in Figure 3.

The network interface controller is basically the heart of the NET section. The interface controller communicates with the CPU board through the controller registers to the RAM. During the startup sequence, the controller loads its address and some initialization from EEPROM.

The network interface controller transmits data packets to the Datex-Ohmeda Network and receives data packets from the network through the 10BASE-T transformer. The transformer filters and transforms the data and also provides the isolation.

The Ethernet status LEDs indicate the status of the network communication. The status LEDs are controlled by the network controller. The LEDs are not visible when the board is installed into the monitor.

The PLD interfaces the coding element. The coding element contains information on the monitor location. The network address is transmitted to the CPU board through the network controller and the monitor location information is transmitted to the CPU board through PLD interface.

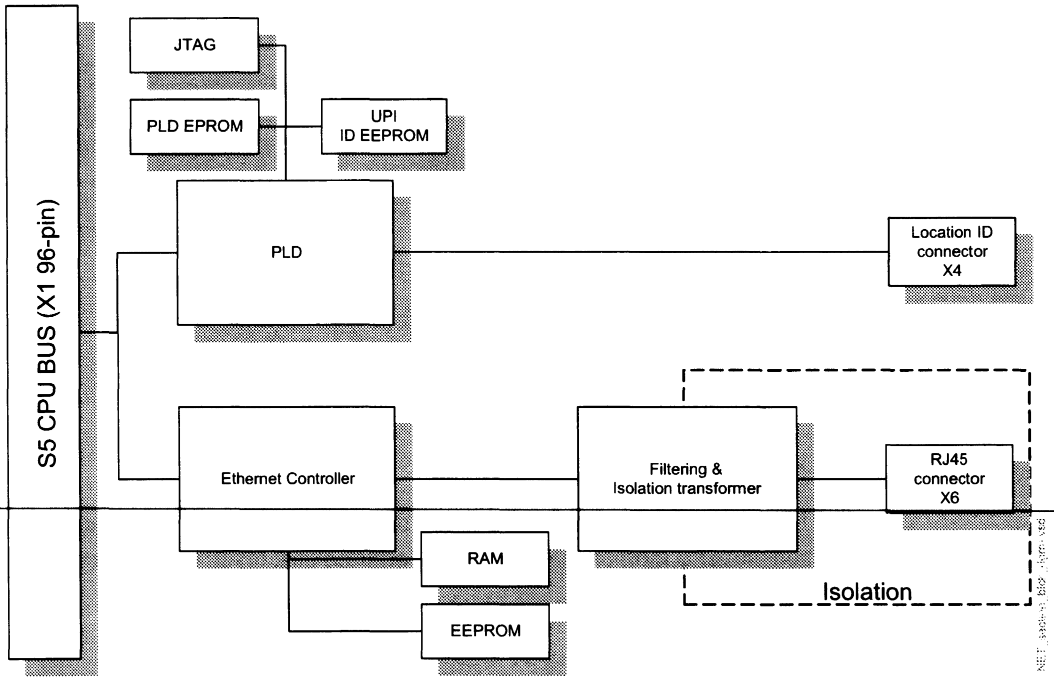


Figure 3 NET section block diagram

2.2 Ethernet interfaces

The data transformer is designed by Datex-Ohmeda and it is hospital grade approved.

Adapter's 10BASE-T is an interface with 7-pole butterworth low-pass filters on the unisolated side of the transformer. There is a common mode choke on the isolated side for both transmitting and receiving lines.

There are also three LEDs on the board, which are not visible from the outside, indicating the following:

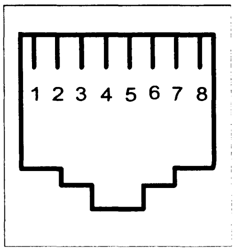
- activity in Ethernet	H1	Green
- collision detection	H3	Yellow
- good link in 10BASE-T interface	H2	Green

The activity LED (H1) flashes when communication packets are detected in the Datex-Ohmeda Network. The collision detection LED (H3) indicates a packet collision on the network. The collision detection LED should flash only occasionally, otherwise there may be a physical layer problem. The good link LED (H2) indicates whether or not the communication link to the HUB is functional. The good link LED should always be lit.

2.3 Connectors and signals

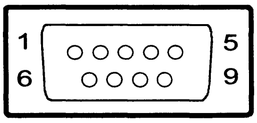
2.3.1 Ethernet Network Interface

Network Connector, X6

RJ45 connector	**Pin**	**Signal**
	1	Tx +
	2	Tx -
	3	Rx +
	4	N/C
	5	N/C
	6	Rx -
	7	N/C
	8	N/C

2.3.2 Network coding element interface

Coding element connector, X4

9 pin female D-connector	**Pin**	**Signal**
	1	IDCS1 (chip select)
	2	IDCL (clock)
	3	IDDI (data in)
	4	IDDO (data out)
	5	IDPE (protect enable)
	6	+5Vdc
	7	N/C (Direct ECG, in B-UPI4NET rev.00 only)
	8	Nurse call
	9	GND

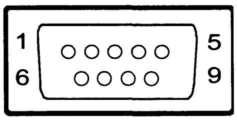
Nurse Call (X4 pin 8)

The Nurse Call signal is generated by yellow and red alarms. When activated, the signal is set to the high state and remains at the high state until the alarm situation is over or the SILENCE ALARM key is pressed. The high state range is from 2.8 to 5 V, while the low state range is from 0 to 0.8 V.

If the output signals are used simultaneously with the coding element, the B-UPINET Y-cable, order number 889308, is recommended.

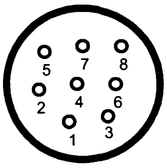
2.3.3 RS232 serial data interface

RS232 Serial data connector X8

9 pin male D-connector	**Pin**	**Signal**
	1	GND
	2	RxD
	3	TxD
	4	NC
	5	GND
	6	N/C
	7	RTS
	8	CTS
	9	N/C

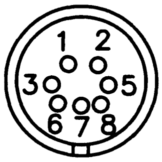
2.3.4 DIS interface (RS422)

DIS connector, X5

10 pin female connector	**Pin**	**Signal**
	1	DIS_out +
	2	DIS_out -
	3	15V_DIS
	4	GND
	5	8V_DIS
	6	GND
	7	DIS_in +
	8	DIS_in -

2.3.5 Synchronization interface

Synchronization connector, connector X7 (B-UPI4NET rev.01)

Mini DIN7 connector	**Pin**	**Signal**
	1	Defib_sync_out
	2	Reserved
	3	Analog GND
	5	Digital GND
	6	GND
	7	Pressure_out
	8	Direct_ECG_out

Defibrillation Sync (pin 1)

Defibrillation Sync indication is generated by ECG. When active, the signal is in state 1. After 10 ms the signal is reset to state 0. New Defibrillation Sync is not generated before the indication is deactivated. The delay from the R wave peak to the start of the signal is maximally 35 ms.

Pressure out (pin 7):

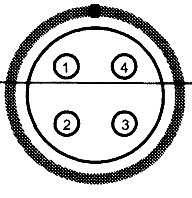
- P1 from hemodynamic module

The Invasive pressure output signal is 1 V/100 mmHg, originally ranging from 0 to 320 mmHg, and with a delay of approximately 25 ms. The signal requires an input impedance of 100 k.

Direct ECG (pin 8):

Delay (max.):	15 ms
Gain ECG (out)/ECG (in):	1 V/1 mV
Pacer:	5 V and 2 ms pulse

Synchronization connector, X7 (B-UPI4NET rev.00)

4 pin female connector	**Pin**	**Signal**
	1	GND
	2	Def_Sync
	3	Direct ECG
	4	Pressure Out

Defibrillation Sync (pin 2)

The defibrillation sync signal is generated by the ECG. When activated, the signal is set to a high level and then set back to a low level after 10 ms. The signal is regenerated only after returning to the low level. The high level ranges from 2.8 to 5 V, while the low level ranges from 0 to 0.8 V. The delay from the R wave peak to the start of the signal is 35 ms maximum.

Direct ECG (pin 4):

Delay (max.):	15 ms
Gain ECG (in)/ECG (out):	1 mV/1V

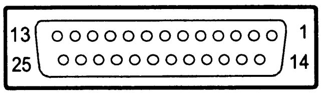
Pressure out (pin 4):

- P1 from hemodynamic module

The Invasive pressure output signal is 1 V/100 mmHg, originally ranging from 0 to 300 mmHg, and with a delay of approximately 25 ms. The signal requires an input impedance of 100 k, with B-UPI4NET rev.00 and monitor software version 03 or earlier.

2.3.6 Printer interface

Standard printer connector, X3

25 pin female D-connector	Pin	Signal
	1	Data_clk
	2	Data0
	3	Data1
	4	Data2
	5	Data3
	6	Data4
	7	Data5
	8	Data6
	9	Data7
	10	N/C
	11	Printer busy
	12	Paper end
	13	N/C
	14	N/C
	15	Error/
	16	N/C
	17	GND
	18	GND
	19	GND
	20	GND
	21	GND
	22	GND
	23	GND
	24	GND
	25	GND

2.3.7 Connection to the S/5 bus

S/5 CPU bus connector X1

Pin	A	B	C
1	+15 V	AGND	DGND
2	-15 V	BALE	DGND
3	SA0	SA1	DGND
4	SA2	SA3	RESET_RS485
5	SA4	SA5	-RESET_RS485
6	SA6	SA7	DATA_RS485
7	SA8	SA9	-DATA_RS485
8	SA10	SA11	TXDD_RS232
9	SA12	SA13	RXDD_RS232
10	SA14	SA15	Direct_ECG_PWM
11	SA16	SA17	BIT1IN
12	SA18	SA19	TXDC
13	SA20	SA21	RXDC
14	SA22	SA23	RTSC
15	-SMEMR	-SMEMW	CTSC
16	-IOR	-IOW	TXDB
17	CLK	-RESET	RXDB
18	-IOCHRDY	IRQ10	RTSB
19	N/C_1	IRQ11	CTSB
20	N/C_2	IRQ12	TXDA
21	-SBHE	IRQ15	RXDA
22	SD0	SD1	RTSA
23	SD2	SD3	CTSA
24	SD4	SD5	LOUDSPEAKER
25	SD6	SD7	+5 V
26	SD8	SD9	+5 V
27	SD10	SD11	+5 V
28	SD12	SD13	+5 V
29	SD14	SD15	ON/STBY
30	+15 VD	-RESET_CPU	+5 V_CPU
31	+15 VD	+32 VD	REFRESH_WD
32	GNDD	GNDD	POWER_FAIL

3 Service procedures

Due to the nature of the UPI4(NET) board, the field service is limited only for troubleshooting. Faulty UPI4(NET) boards are returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation, and a detailed fault description.

CAUTION Only trained personnel with appropriate tools and equipment are allowed to perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.1 Service check

These instructions include complete procedures for a service check. The service should be performed after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A") which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check form should be signed after performing the procedure.

3.1.1 Recommended tools

Tool	Order No.	Notes
Command Bar / Command Board		
Hemodynamic parameter module		
Datex-Ohmeda Network		only for UPI4NET
Mon-Net cable		only for UPI4NET
Patient simulator		
Screwdriver		

3.1.2 Visual inspection

Make sure the monitor is switched to standby. Press the service reset switch at back of the power supply unit for at least five seconds. Disconnect the Mon-Net cable, Identification plug and Network cable extension from the UPI4NET board, if installed.

Detach all PC boards from the right side of the UPI4(NET) board. Detach the UPI4(NET) board carefully by pulling it from the connector X3 (25 pin female D-connector).

NOTE: The UPI4(NET) board contains components on both sides of the PC board. Therefore, the detachment and installation of the UPI4(NET) board should be done with extra care.

NOTE: Wear a static control wrist strap when handling PC boards. Electrostatic discharge may damage components on the board.

1. UPI4(NET) board connectors

   Check that the UPI4(NET) board connectors are intact and all connector cables are connected properly on the PC board.

   ✍

2. PC board components and IC attachment

   Check that none of the PC board components is damaged (on both sides) and the IC on a socket is attached properly.

   ✍

3. Screws

   Check that all block screws for cables are in place and tightened properly. Check also that their threads are intact.

   ✍

4. Grounding plate

   Check that the grounding plate under the PC board rear panel is attached properly and is not bent.

   ✍

3.1.3 Functional inspection

UPI functions

Re-install the UPI4(NET) board carefully together with the other detached PC boards. Do not connected any cables to the UPI4(NET) board at this point. Switch the monitor on. Make sure that the Hemodynamic parameter module is installed. Connect a patient simulator to the module.

5. Parameter data and waveforms

   Check that the displayed parameter data and waveforms are reasonable.

   ✍

6. Voltage and temperature

   Enter the service menu.

   Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8) - ***Frame*** - ***Power Supply***

   Check that the displayed voltage and temperature values (measured by the UPI4(NET) board) are reasonable.

   ✍

7. Watchdog

   Test the UPI4(NET) board watchdog function.

Set / Test - WD by UPly

Perform the test and check that monitoring continues normally.

✍

NET functions

8. Network cable extension

   Check the Network cable extension:

   - the cable is intact
   - the cable connectors are clean and intact
   - the claw for locking the cable to the Network Board is intact

   Connect the Network cable extension to the UPI4NET board.

   ✍

9. Mon-Net cable and ID-plug

   Check that the Mon-Net cable connector and the Identification plug are clean and intact, then connect them to the UPI4NET board.

   Check that the monitor connects to the Datex-Ohmeda Network, i.e. the network symbol appears under the clock on the upper right hand corner of the screen.

   A message regarding the connected Datex-Ohmeda Central should appear in the message field of the screen.

   NOTE: If the network symbol does not appear, check the status of the network.

   ✍

10. Ethernet address

    Enter the service menu.

    Frame - Network

    Take down the monitor's Ethernet address that is shown beside the text "Address".

    ✍

11. "In", "Out" data counters

    Check that the service menu counters for the received ("In") and transmitted ("Out") data are updated frequently.

    ✍

12. Data error counters

    Check that the counters for data errors ("CRC", "Frame", "Transm.") are stable.

    NOTE: The counters may show values higher than 0. However, if any of the values is increasing continuously, it indicates a problem.

    ✍

13. Hardware error counters

    Check that the counters for hardware errors (“Intern.”, “Missed”, “FIFO”, “Overrun”) all show 0. If any of the counters show a value higher than 0, replace the UPI4NET board.

    ✍

14. Recognition of disconnection

    Disconnect the Mon-Net cable from the Network cable extension. Check that the message “Network down:” appears in the message field within 30 seconds. Reconnect the Mon-Net cable and check that the monitor connects to the network again.

    ✍

15. Recognition of ID-plug

    Switch the monitor to standby. Disconnect the Identification plug from the UPI4NET board. Switch the monitor back on and check that the message “Check network connectors” appears in the message field. Reconnect the Identification plug and check that the monitor connects to the network.

    ✍

General

16. Electrical safety check

    Perform an electrical safety check and a leakage current test.

    ✍

17. Functioning after electrical safety test

    Check that the Network Board functions normally after the performed electrical safety check.

    ✍

- Fill in all necessary documents.

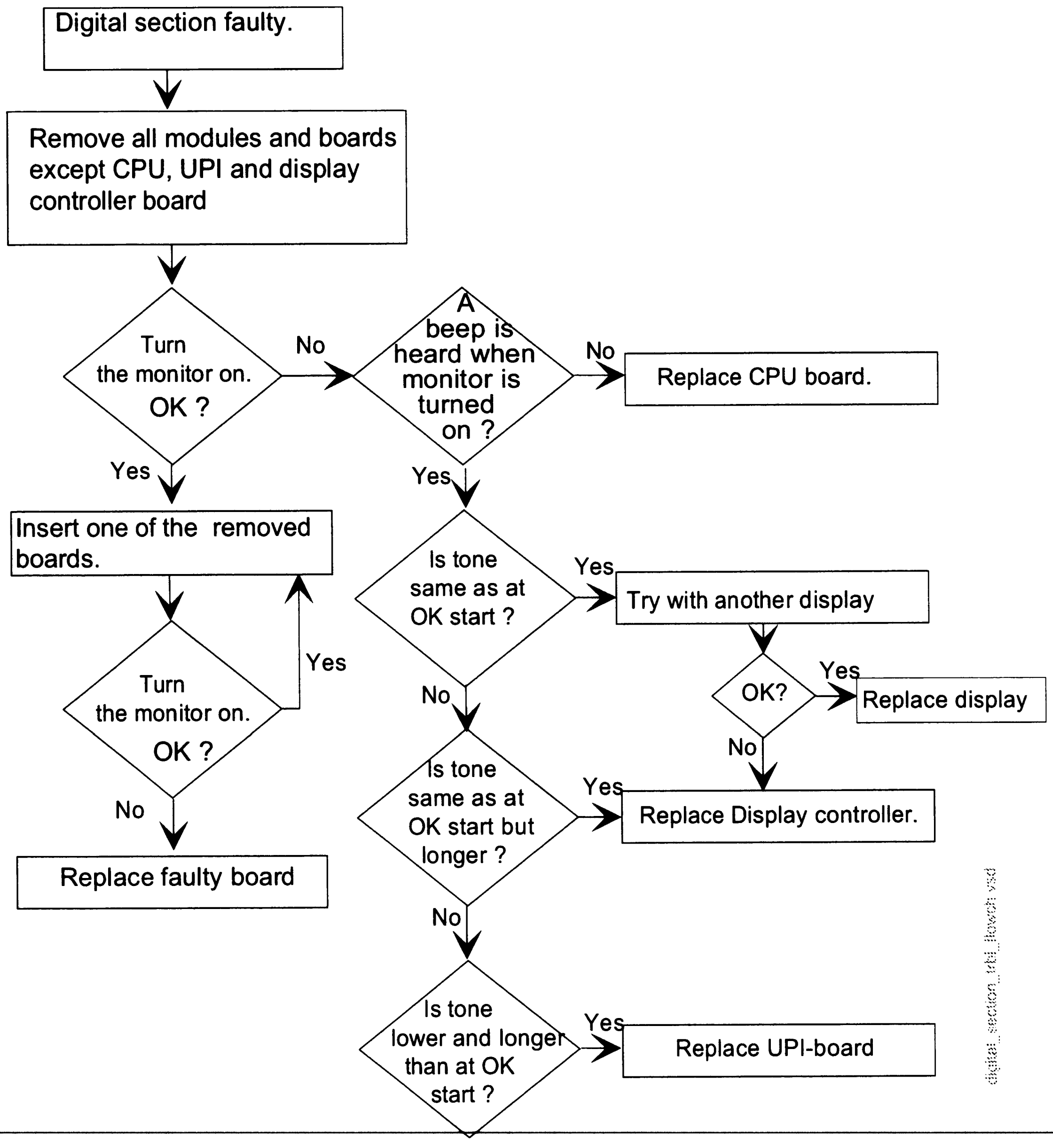
4 Troubleshooting

4.1 Troubleshooting for the NET section

Symptom at the monitor end	**Problem at**	**Explanation/What to do**
Monitor does not connect to the network. Monitor connects to the network, but disconnects unexpectedly ('Network connection down' message on the monitor screen).	Patch panel	Patch cable not connected to HUB or to panel.
	Patch cable	Patch cable or connector defective.
		HUB not connected to power supply.
		HUB port closed due to physical layer problems.
		HUB port temporarily closed and reopened due to physical layer problems.
		HUBs not properly connected to each other.
	Monitor-Network cable	Cable not properly connected to the wall plate or to the monitor.
	Monitor-Network cable	Cable or connector defective.
	UPI4NET board	The UPI4NET board is defective. The board cannot be used. See network service page for details.
	UPI4NET board EEPROM	The EEPROM of the UPI4NET board is defective or uninitialized. The board cannot be used. See network service page for details.
	Identification plug	There is no identification plug attached to the monitor.
		The identification plug is defective or uninitialized. The plug cannot be used.
'Network EEPROM Error' message shows on the monitor screen	UPI4NET board EEPROM	The EEPROM of the UPI4NET board is defective or uninitialized. The board cannot be used. See Network service page for details.
'Check network connectors' message shows on the monitor screen	Monitor-Network cable	Cable not properly connected to the wall plate or to the monitor.
		Cable or connector defective.
	Identification plug	There is no identification plug properly attached to the monitor.
		The identification plug is defective or uninitialized. The plug cannot be used. See network service page for details.

Symptom at the monitor end	**Problem at**	**Explanation/What to do**
'Network board error' message shows on the monitor screen	UPI4NET board	The UPI4NET board is defective. The board cannot be used. See network service page for details.
	UPI4NET board EEPROM	The EEPROM of the UPI4NET board is defective or uninitialized. The board cannot be used. See network service page for details.
Other Site View shows no waveforms	No waveforms are set up for Monitor-to-Monitor communication	Run Network Setup to verify current Monitor-to-Monitor communication setup.
Network printing fails	Print server is busy	Network manager's print server is busy at the moment and cannot take more print jobs. Try again after 15 seconds.
	Print queue is full	There are too many unprinted documents waiting in the print queue. Check the printer, as it is not operating properly.
	Printer is off-line	Printer cable is loose, printer is out of paper, there is a paper jam or the printer is simply switched to off-line state.
Record keeper menus are blank	There are no menus for the record keeper	Run Network Setup to verify the current set up.

4.2 Troubleshooting for the UPI section


Digital section faulty.
Remove all modules and boards except CPU, UPI and display controller board
Turn the monitor on. OK ?
No
A beep is heard when monitor is turned on ?
No
Replace CPU board.
Yes
Insert one of the removed boards.
Yes
Is tone same as at OK start ?
Yes
Try with another display
OK?
Yes
Replace display
No
Turn the monitor on. OK ?
Yes
No
Replace faulty board
No
Is tone same as at OK start but longer ?
Yes
Replace Display controller.
No
Is tone lower and longer than at OK start ?
Yes
Replace UPI-board

5 Earlier revisions

This manual supports only UPI4 Board, B-UPI4 and UPI4NET Board, B-UPI4NET.

See information related to the earlier revisions of UPI board in the main manual 896624 and slot 895704-1.

APPENDIX A Service check form UPI4(NET) Board, B-UPI4(NET)

Customer		
Service	Board type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

General	**OK**	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
1. UPI4(NET) board connectors	☐	☐	☐	2. PC board components and IC attachment	☐	☐	☐
3. Screws	☐	☐	☐	4. Grounding plate	☐	☐	☐
Notes							
Upi functions							
5. Parameter data and waveforms	☐	☐	☐	6. Voltage and temperature	☐	☐	☐
7. Watchdog	☐	☐	☐				
Notes							
NET functions							
8. Network cable extension	☐	☐	☐	9. Mon-Net cable and ID-plug	☐	☐	☐
10. Ethernet address	Address						
11. "In", "Out" data counters	☐	☐	☐	12. Data error counters	☐	☐	☐
13. Hardware error counters	☐	☐	☐	14. Recognition of disconnection	☐	☐	☐
15. Recognition of ID-plug	☐	☐	☐				
Notes							
General							
16. Electrical safety check	☐	☐	☐	17. Functioning after electrical safety test	☐	☐	☐
Notes							

Notes

Used Spare Parts			

Signature

Datex-Ohmeda

Video Display, D-VNC15 (Rev. 03)
S/5™ Video Display, D-VMC15 (Rev. 00)
S/5™ Video Display, D-VHC17 (Rev. 03)
S/5™ 21" Display Monitor Unit, D-VSC21 (Rev. 02)

S/5™ LCD Display, D-LCC10A/W (Rev. 01)
S/5™ 12" LCD Display, D-LCC12A (Rev. 01)
S/5™ 15" LCD SDisplay, D-LCC15 (Rev. 03)
S/5™ 17" LCD Display, D-LCC17 (Rev. 00)
S/5™ 19" LCD Display, D-LCC19 (Rev. 00)
S/5™ 42" Plasma Display, D-MMP42 (Rev. 00)
S/5™ 43" Plasma Display, D-MMP43 (Rev. 00)

S/5™ Display Controller Board, B-DISP (Rev. 01)
S/5™ Display Controller Board, B-DISP19 (Rev. 00)
S/5™ Display Controller Board, B-DISPX (Rev. 00)

Technical Reference Manual Slot

All specifications are subject to change without notice.

CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

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June, 2005

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Appendix B: Service check form, Video Display, D-VNC15 B-1

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Appendix E: Service check form, LCD Displays, D-LCC10A, D-LCC10W E-1

Appendix F: Service Check Form, LCD Display, D-LCC12A F-1

Appendix G: Service Check Form, LCD Display, D-LCC15 G-1

Appendix H: Service check form, LCD Display, D-LCC17, D-LCC19 H-1

Appendix I: Service check form, Plasma Display, D-MMP42 and D-MMP43 **I-1**

Introduction

This section provides information about the maintenance and service of the following products:

- Video Displays, D-VMC15, D-VNC15, D-VHC17 and D-VSC21
- LCD Displays, D-LCC10A/W, D-LCC12A, D-LCC15, D-LCC17 and D-LCC19
- Plasma Displays, D-MMP42 and D-MMP43
- Display controller boards, B-DISP, B-DISP19 and B-DISPX

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

The following tables summarize the display - display contoller board compatibility and the required resolution settings for the displays.

Table 1 Compatibility

	B-DISP	B-DISP19	B-DISPX *
D-VNC15	X	X	X
D-VMC15	X	X	X
D-VHC17	X	X	X
D-VSC21	X	X	X
D-LCC10 A/W	X	X	
D-LCC12A	X	X	X
D-LCC15	X	X	X
D-LCC17		X	X
D-LCC19		X	X
D-MMP42	X	X	X
D-MMP43	X	X	X

*B-DISPX requires monitor software L-ANE03, L-ANE03A revision 03 and later (if available) or L-ICU03 and L-ICU03A revision 03 and later (if available)

Table 2 Resolution settings

	VGA	XGA	HiRes	SVGA	SXGA
D-VNC15			X		
D-VMC15			X		
D-VHC17			X		
D-VSC21			X		
D-LCC10 A/W	X				
D-LCC12A				X	

	VGA	**XGA**	**HiRes**	**SVGA**	**SXGA**
D-LCC15		**X**			
D-LCC17		**X**			**X**
D-LCC19		**X**			**X**
D-MMP42		**X**			
D-MMP43		**X**			

1 Specifications

1.1 Video Display, D-VMC15 (Rev. 00)

Dimensions	
W × D × H	339 × 432 × 366 mm
Weight	15 kg
CRT	
Diagonal	15”
Face treatment	Black matrix with anti-reflection, antistatic
Deflection angle	90°
Phosphor	P22
Aperture grille pitch	0.28 mm
Resolution	
Horizontal × Vertical	1024 × 768 / 75 Hz
Electrical requirements	
Line voltage	AC, 90...264 V, 47... 63 Hz
Power consumption	< 110 W
Environmental requirements	
Ambient temperature:	
Operating	+0°C...+40°C
Packed	-20°C...+65°C
Relative humidity:	
Operating	10%...95%, non-condensing

1.2 Video Display, D-VNC15 (Rev. 03)

Dimensions	
W × D × H	362 × 400 × 381 mm
Weight	14 kg
CRT	
Diagonal	15”
Face treatment	non-glare, antistatic
Deflection angle	90°
Phosphor	P22
Aperture grille pitch	0.25 mm
Resolution	
Horizontal × Vertical	1024 × 768
Electrical requirements	
Line voltage	AC, 90...264 V, Autosense, 50/60 Hz
Power consumption:	
Normal operation	< 100 W
Stand-by	~ 70 W
Suspend	< 15 W
Auto power off	< 5 W

Environmental requirements

Ambient temperature:	
Operating	+10°C...+40°C
Packed	-20°C...+60°C
Relative humidity:	
Operating	15%...85%
Packed	5%...95%

1.3 Video Display, D-VHC17 (Rev. 01)

Dimensions

W × D × H	410 × 465 × 429 mm
Weight	22 kg

CRT

Diagonal	17"
Face treatment	Black matrix, invar shadow mask, Anti-Reflection coat
Deflection angle	90 °
Phosphor	Short persistence phosphors
Aperture grille pitch	0.22 mm (optional 0.24 mm)

Resolution

Horizontal × Vertical	1280 × 1024

Electrical requirements

See power connection requirements related to S/5 systems from *Part I/Installation*.

Line voltage	AC, 110...120/200...240 V, automatically selected. Provided with power save circuit.
Power consumption	110 W (nominal)
Warm-up time	30 minutes to reach optimum performance level.

Environmental requirements

Ambient temperature:	
Operating	+10°C...+30°C
Storage	-20°C...+60°C
Relative humidity:	
Operating	10%...80%
Storage	10%...90%

1.4 Video Display, D-VHC17 (Rev. 02)

Dimensions

W × H × D	415 × 410 × 500 mm
Weight	20.0 kg/44,1 lbs (approx.)

CRT

Diagonal	17"
Face treatment	ARASC coating
Deflection angle	90°
Aperture grille pitch	0.26 mm (optional 0.28 mm) dot-pitch

Resolution

Horizontal × Vertical	1984 × 512

Electrical requirements

See power connection requirements related to S/5 systems in *Part I/Installation*.

Power supply	90...132 VAC, 60/50 Hz, 2.0 A 180...264 VAC, 60/50 Hz, 1.2 A (auto select)
Power consumption	135 W max.

Environmental requirements

Ambient temperature:	
Operating	+10°C...+35°C
Relative humidity:	
Operating	10%...90%

1.5 Video Display, D-VHC17 (Rev. 03)

Dimensions

W × H × D	404 x 443 x 477 mm
Weight	21.9 kg / 47.7 lbs (approx.)

CRT

Diagonal	17”
Face treatment	Non-glare
Horizontal pitch	0.25 mm

Resolution

Horizontal × Vertical	1600 × 1200

Electrical requirements

See power connection requirements related to S/5 systems from *Part I/Installation*.

Power supply	100...240 VAC, 50/60 Hz
Power consumption	105 W max.

Environmental requirements

Ambient temperature:	
Operating	+10°C...+35°C
Relative humidity:	
Operating	10%...90%

1.6 21” Display Monitor Unit, D-VSC21 (Rev. 02)

~~**Dimensions**~~

W × D × H	516 × 518 × 513 mm
Weight	32 kg 70 lbs

CRT

Diagonal	53.3 cm/21” full square
Face treatment	CRT with invar shadow mask
Dot pitch	0.28 mm/0.22 horizontal

Resolution

Horizontal × Vertical	1280 × 1024 @ 90 Hz 1600 × 1280 @ 76 Hz

Electrical requirements

Line voltage	AC, 90...260 V / autosense, 50/60 Hz
Power consumption	< 160 W

Environmental requirements

Ambient temperature:	
Operating	+10°C...+40°C
Storage	-20°C...+60°C
Relative humidity:	
Operating	15%...85%
Storage	5%...95%

1.7 LCD Display, D-LCC10 A/W (Rev. 01)

Display size	10.4 in
Display type	Active Matrix Color LCD Display
Resolution	640 × 480 × (R,G,B)

Dimensions

Outline (ComWheel™ included)	
W × D × H	315 × 74 × 265.5 mm (12.4 × 2.9 × 10.5 in)
Weight	3.5 kg (7.7 lb)

Electrical requirements

The LCD display is connected to the display controller board, B-DISP.

Power consumption	14 W

Environmental Requirements

Operating temperature	+10...+35°C (50-95°F)
Storage temperature	-10...+50°C (14-122°F)
Atmospheric pressure	660...1060 hPa (660...1060 mbar)
Relative humidity	10...90% non-condensing

1.8 LCD Display, D-LCC12A (Rev. 01)

Display size	12.1 in diagonal (31cm)
Display type	Active Matrix Color TFT LCD
Display Resolution	SVGA, 800 x 600

Dimensions

W × D × H	315 x 68 x 265 mm (12.4 x 2.7 x 10.4in)
Weight	2.75kg (6.1lb)
Connection cable	3 m

Electrical requirements

The LCD display is connected to the display controller board B-DISP, B-DISP19 or B-DISPX.

Power consumption	15 W

Environmental requirements

Operating temperature	+10...+35 °C (50...95°F)
Storage temperature	-10...+60 °C (14...140°F)
Relative humidity	10...93% non-condensing

1.9 LCD Display, D-LCC15 (Rev. 00-03)

Display size	15 in diagonal
Display type	Active Matrix Color TFT LCD Display
Resolution	XGA, 1024 x 768

Dimensions

Outline (ComWheel included)	
W × D × H	410 x 100 x 355 mm (16.1 x 3.9 x 14.0 in)
Weight	6,6 kg (14.5lb) with desk stand

Electrical requirements

The LCD display is connected to the display controller board, B-DISP, B-DISP19 or B-DISPX and the power adapter for D-LCC15.

Rated voltage range	100 ... 240 V, 50 ... 60 Hz
Power consumption:	
ON	40 W
Stand-by	5 W
Suspend	5 W

Environmental Requirements

Operating temperature	+0...+40°C (+32...+104°F)
Storage temperature	-20...+60°C (-4...+140°F)
Atmospheric pressure	660...1060 hPa (660...1060 mbar)
Relative humidity	10...90% non-condensing

1.10 LCD Display, D-LCC17 (Rev. 00)

Display size	17,4 in diagonal
Display type	Active Matrix Color TFT LCD Display (AMLCD-TFT)
Resolution	SXGA, 1280 x 1024

Dimensions

Outline		
W x D × H	450 x 65.7 x 377 mm (17.7 x 2.6 x 14.8 in)	
Weight	VESA Mounting (Monitor only):	4.8 kg (10.6 lb)
	Deskstand Mounting (Monitor only):	8.8 kg (19.4 lb)
	Power supply:	0.7 kg (1.5 lb)

Electrical requirements

The LCD display is connected to the display controller board, B-DISP19 or B-DISPX and the power adapter for D-LCC17.

Rated voltage range	100 ... 240 V, 50 ... 60 Hz
Power consumption:	
ON	60 W
Stand-by	5 W
Suspend	5 W
OFF	5W

Environmental Requirements

Operating temperature	+0...+40°C (+32...+104°F)
Storage temperature	-20...+65°C (-4...+149°F)
Atmospheric pressure	660...1060 hPa (660...1060 mbar)
Relative humidity	10...90% non-condensing

1.11 LCD Display, D-LCC19 (Rev. 00)

Display size	19 in diagonal
Display type	Active Matrix Color TFT LCD Display
Resolution	SXGA, 1280 x 1024

Dimensions

W × D × H	429.5 x 235 x 431 mm (16.9 x 9.3 x 17 in)
Weight	7 kg (15.4 lb) with desk stand

Electrical requirements

The LCD display is connected to the display controller board, B-DISP19 or B-DISPX and the power adapter for D-LCC19.

See power connection requirements related to S/5 systems in *Part I/Installation*.

Rated voltage range	100 ... 240 V, 50 ... 60 Hz
Power consumption:	
ON	46 Wmax
Stand-by	5 W
Suspend	5 W

Environmental Requirements

Operating temperature	+0...+40°C (+32...+104°F)
Storage temperature	-20...+60°C (-4...+140°F)
Atmospheric pressure	660...1060 hPa (660...1060 mbar)
Relative humidity	10...85% non-condensing

1.12 Plasma Display, D-MMP42

Display size	42 in diagonal
Display type	Plasma display panel
Resolution	XGA, 1024 x 768
Aspect ratio	16:9
Dimensions W x D x H	1032 x 643 x 91.5 mm (40.6 x 25.3 x 3.6 in)
Weight	34 kg (75 lb) without stand, 41kg (90.3 lb) with stand

Electrical Requirements

Rated voltage range	100...240 V, 50/60Hz
Power consumption	430 W average

Environmental requirements

Operating temperature	+5°C... +40°C (+41...+104°F)
Operating atmospheric pressure	800... 1100 hPa
Relative operating humidity	20...85% non-condensing

1.13 Plasma Display, D-MMP43

Display size	43 in diagonal
Display type	Plasma display panel
Resolution	1024 x 768
Aspect ratio	16:9
Dimensions W x D x H	1070 x 630 x 98 mm (42.13 x 24.8 x 3.86 in)
Weight	31,5 kg (69 lbs 7 oz.)

Electrical Requirements

Rated voltage range	100-240 +/-10%, 50/60Hz 100-120 +/-10%, 50/60Hz (US)
Power consumption	298VA max

Environmental requirements

Operating temperature	+0°C... +40°C (+32...+104°F)
Operating atmospheric pressure	800... 1100 hPa
Relative operating humidity	20...80% non-condensing

1.14 Display Controller Boards, B-DISP, B-DISP19 and B-DISPX

Video output of B-DISP: analog RGB, 0.3V - 1.1V, $0.8V_{pp}$, 75 ohm

Video output of B-DISP19: analog RGB, 0.0V - 0.8V, $0.8V_{pp}$, 75 ohm

Video output B-DISPX: analog RGB and DVI, 0.0V – 0.7V, $0.7V_{pp}$, 75 ohm

Output data

High resolution

Resolution	1984 × 512 pixels
Frame frequency	65 Hz
Scan frequency	34.7 kHz
Dot frequency	80 MHz
Sync polarity	H/negative, V/negative, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.245 µs	0.058 ms
Sync pulse	1.200 µs	0.115 ms
Back porch	2.560 µs	0.464 ms
Blank pulse	4.000 µs	0.636 ms
Sweep time	28.80 µs	15.40 ms

VGA resolution

Resolution	640 × 480 pixels
Frame frequency	60 Hz
Scan frequency	31.6 kHz
Dot frequency	25 MHz
Sync polarity	H/negative, V/negative, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.624 µs	0.38 ms
Sync pulse	3.52 µs	0.062 ms
Back porch	1.968 µs	1.016 ms
Sweep time	31.61 µs	16.63 ms

High resolution (Japan)

Resolution	1600 × 600 pixels
Frame frequency	67 Hz
Scan frequency	41.7 kHz
Dot frequency	80 MHz max.
Sync polarity	H/negative, V/negative, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.40 s	57.6 µs
Sync pulse	1.20 µs	115.2 µs
Back porch	2.40 s	460.8 µs

SVGA resolution

Resolution	800 × 600 pixels
Frame frequency	60 Hz
Scan frequency	37.9 kHz
Dot frequency	40 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	1 µs	0.027 ms
Sync pulse	3.2 µs	0.105 ms
Back porch	2.2 µs	0.612 ms
Sweep time	26.39 µs	16.67 ms

XGA resolution

Resolution	1024 × 768 pixels
Frame frequency	75 Hz
Scan frequency	60.2 kHz
Dot frequency	78.75 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.205 µs	0.017 ms
Sync pulse	1.216 µs	0.05 ms
Back porch	2.24 µs	0.469 ms
Sweep time	16.61 µs	13.33 ms

SXGA resolution

Resolution	1280 × 1024 pixels
Frame frequency	60.13 Hz
Scan frequency	64.1 kHz
Dot frequency	108.4 MHz
Sync polarity	H/positive, V/positive, level TTL

Sync pulse:

	Horizontal	**Vertical**
Front porch	0.45 µs	0.0158 ms
Sync pulse	1.032 µs	0.0466 ms
Back porch	2.28 µs	0.626 ms
Sweep time	15.6 µs	16.63 ms

2 Functional description

2.1 Video Displays D-VMC15, D-VNC15, D-VHC17 and D-VSC21

The displays are suitable for high end applications using graphical interface. The adjustments and selections are carried out through displays' internal menus. The displays synchronize and adjust automatically with a wide range of scanning frequencies.

The power for the D-VNC15 and D-VHC17 rev. 02 -03 should be supplied via F-CU8 or via an External separating transformer. D-VMC15 can be supplied via F-CU8 or directly from mains without external separating transformer. D-VSC21 should always be supplied through external separating transformer.

All the displays contain a degaussing (demagnetization) circuitry. Degaussing takes place automatically when the monitor is turned on, however, the degaussing can be activated also manually during operation, if necessary.

NOTE: Connecting the displays to the B-DISPX board's DVI connector requires the DVI - VGA adapter cable (order No. M1005320) in addition to the displays' own video cable.

2.2 LCD Displays, D-LCC10A/W, D-LCC12A, D-LCC15, D-LCC17, D-LCC19

NOTE: The LCD display backlight circuit runs on a high voltage. Do not touch the inverter board when powered.

LCD Displays D-LCC10A/W and D-LCC12A include LCD display module, LCD interface board, and keyboard. The display keyboard works independent of the main keyboard.

The LCD Displays, D-LCC15, D-LCC17 and D-LCC19 include LCD display module and LCD interface board.

The LCD Display is connected to the Display controller board B-DISP, B-DISP19 or B-DISPX (depending on the LCD display type) in the monitor frame with the LCD display interface cable.

Video signalling between the Display controller board B-DISP, B-DISP19 and the LCD Display takes place in analog form. Incoming signals are buffered in the Interface board, converted into digital form, and fed forward to the LCD Display module.

B-DISPX sends video signals in both analog and digital form through its DVI connector.

~~Communication between the Display controller board and the keyboard is in RS232 serial format.~~

NOTE: D-LCC10A/W requires B-DISP and it is the only functional solution for 10" displays.

NOTE: D-LCC12A and D-LCC15 require B-DISP, B-DISP19 or B-DISPX.

NOTE: D-LCC17 and D-LCC19 require B-DISP19 or B-DISPX.

2.2.1 D-LCC10A/W

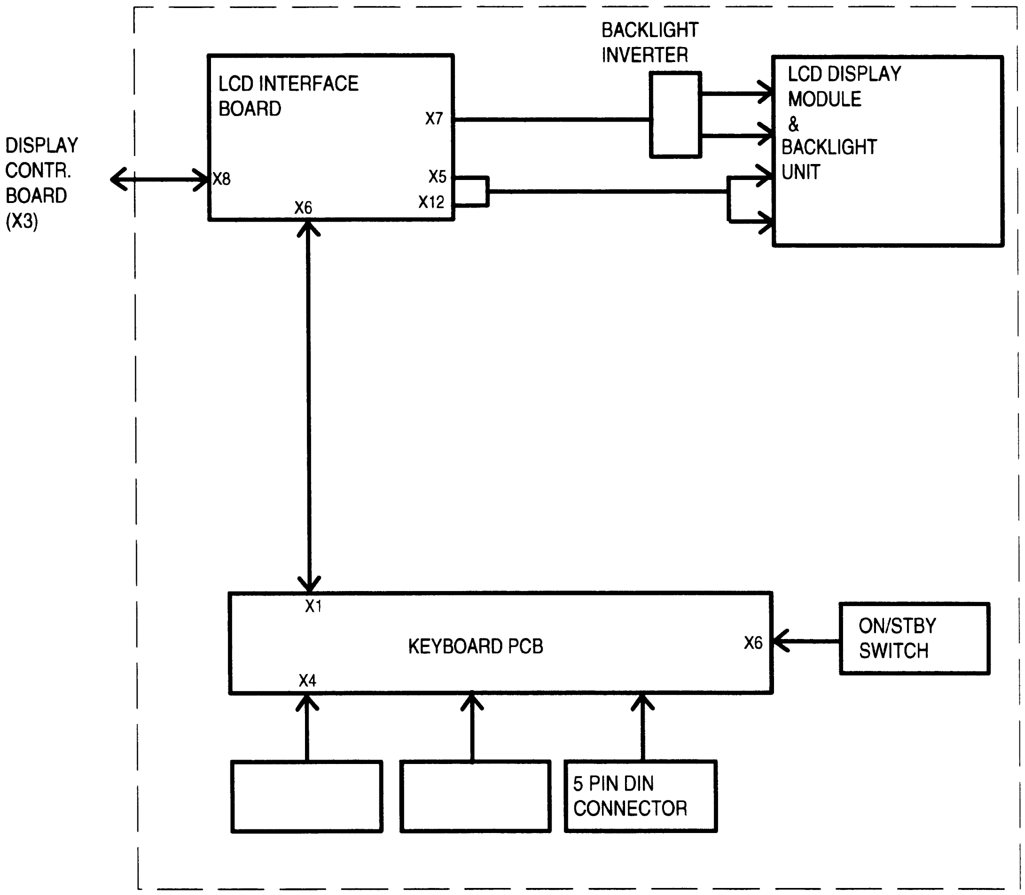

BACKLIGHT
INVERTER
LCD INTERFACE
BOARD
X7
X8
X6
X5
X12
LCD DISPLAY
MODULE
&
BACKLIGHT
UNIT
DISPLAY
CONTR.
BOARD
(X3)
X1
KEYBOARD PCB
X6
X4
ON/STBY
SWITCH
5 PIN DIN
CONNECTOR

Figure 1 **General block diagram, D-LCC10A/C (rev. 01)**

LCD interface board

The LCD Interface board is the interface between the display controller board and the LCD display component. The keyboard is also connected to the Interface board, see Figure 1.
The incoming signal to the LCD Interface board is pure analog VGA - RGB with separate horizontal and vertical synchronisation signals, see Figure 2. The display element uses digital RGB-signals, HSYNC, VSYNC, DOTCLK and a display timing signal DTMG. The DTMG signal indicates that the digital RGB-signals are active.
The functions of this board are digitalization of the video signals, regeneration of the DOTCLK and generation of the DTMG. The backlight driver is also located on the board.

Power supply, D-LCC10A/W

The DC/DC power supply is an isolated discontinuous mode fly back switcher. It has a current mode PWM circuit and a separate FET switch on the primary side. The transformer has two secondary windings, one for 5V and another for 12V. On the secondary side (5V), there is a separate chip on the feedback path to drive the optoisolator.

Backlight unit, D-LCC10A/W

The backlight unit consists of two changeable tubes fed by a separate inverter board.

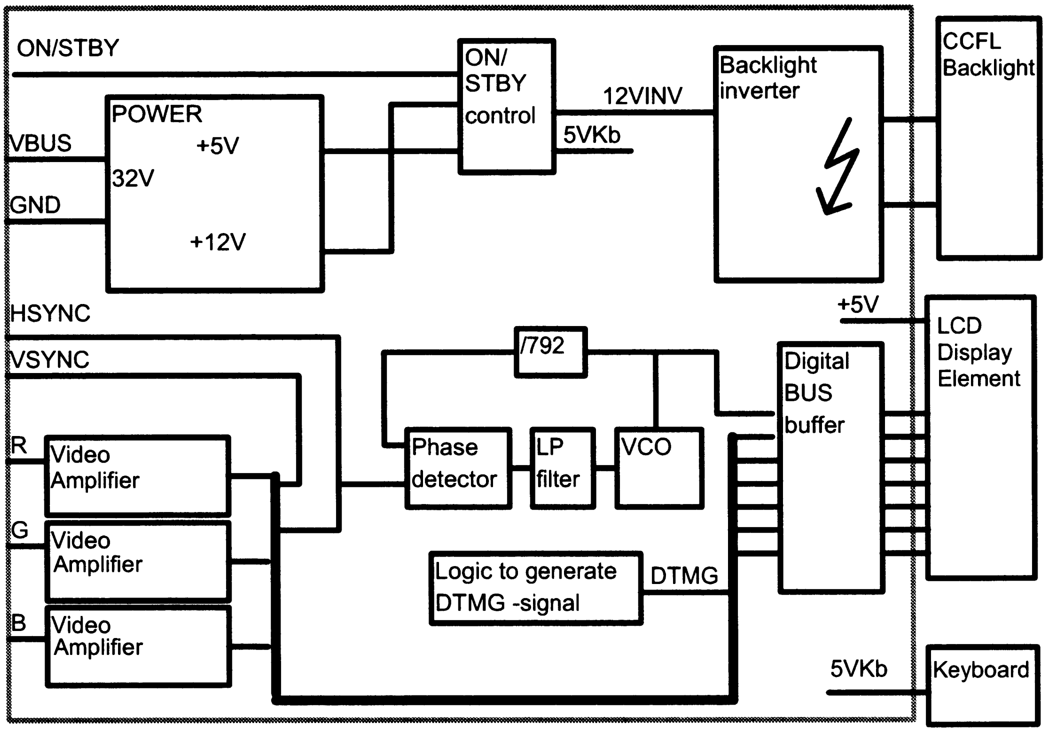
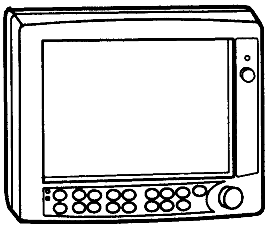

ON/STBY
VBUS
GND
POWER
+5V
32V
+12V
ON/
STBY
control
12VINV
5VKb
Backlight
inverter
CCFL
Backlight
HSYNC
VSYNC
+5V
/792
Digital
BUS
buffer
LCD
Display
Element
R
Video
Amplifier
G
Video
Amplifier
B
Video
Amplifier
Phase
detector
LP
filter
VCO
Logic to generate
DTMG -signal
DTMG
5VKb
Keyboard

Figure 2 **LCD interface board block diagram, D-LCC10A/C**

2.2.2 D-LCC12A

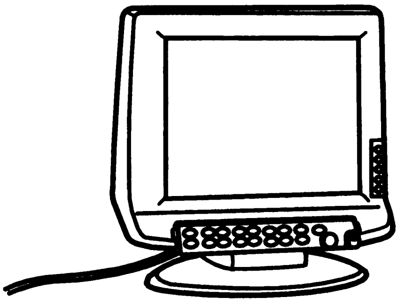


D-LCC12A is a 12-inch LCD display, which is intended for use in the S/5 Anesthesia Monitor. D-LCC12A display has an integrated Command Board with monitor controls, menu keys and ComWheel.

D-LCC12A is a medical grade display.

The display can be mounted on a desk stand, wall or various anesthesia machines.

2.2.3 D-LCC15



D-LCC15 Rev.03

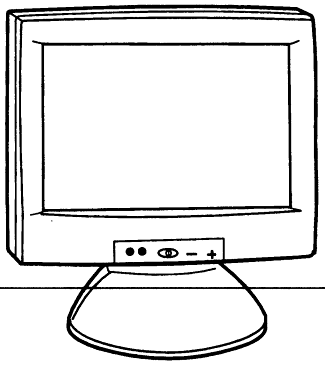
With the previous revisions of the D-LCC15, the OSD menu was entered using the lower most key on the display side panel, whereas with the D-LCC15 Rev.03 the OSD menu is entered using the upper most key. More information about the actual content of the OSD menu can be found in the display's Operations Manual that is delivered with each D-LCC15.

The D-LCC15 Rev.03 can accept either analog or digital video signal.

NOTE: Due to the change in the video input connector, the D-LCC15 Rev.03 is delivered with a 3m/10ft video cable of type DVI-VGA. The cable incorporates a male 29-pin locking DVI connector at one end (for connection to the LCD display) and a male 15-pin D-sub connector at the other end (for connection to the display controller board).

A 3m/10 ft DVI-DVI video cable is also delivered with the display.

2.2.4 D-LCC17



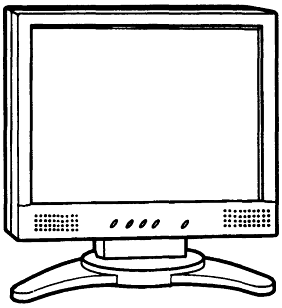
The D-LCC17 is a 17" LCD display that is intended for primary or secondary display use with Datex-Ohmeda S/5 Anesthesia and Critical Care Monitors.

The D-LCC17 is a medical grade product.

The D-LCC17 is delivered with a medical grade AC power adapter that is connected between the D-LCC17 and the power output on the Central Unit (F-CU8), or between the D-LCC17and a wall socket.

The D-LCC17 does not contain a place for the S/5 Command Bar.

2.2.5 D-LCC19



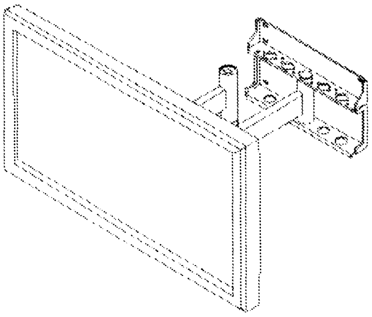
The D-LCC19 is intended for a secondary display use with Datex-Ohmeda S/5 Anesthesia and Critical Care Monitors.

The D-LCC19 is a non-medical grade product. The display must be mounted at least 180 cm / 71" high to prevent any liquid from entering the display casing.

The D-LCC19 must be supplied through an external separating transformer.

The D-LCC19 does not contain a place for the S/5 Command Bar.

2.3 Plasma Displays



2.3.1 Plasma Display, D-MMP42

The display is intended for a secondary display use with Datex-Ohmeda S/5 Anesthesia and Critical Care Monitors.

D-MMP42 must be supplied through an external separating transformer.

NOTE: If the same image is displayed continuously, a permanent after image may remain on the screen. This is due to burning of the fluorescent material, and is typical of all plasma displays.

The 42" Plasma Display D-MMP42 is not a medical grade display.

2.3.2 Plasma Display, D-MMP43

The display is intended for a secondary display use with Datex-Ohmeda S/5 Anesthesia and Critical Care Monitors.

D-MMP43 must be supplied through an external separating transformer.

NOTE: If the same image is displayed continuously, a permanent after image may remain on the screen. This is due to burning of the fluorescent material, and is typical of all plasma displays.

The 43" Plasma Display D-MMP43 is not a medical grade display.

2.4 External connector configurations

Table 3 Main connector on LCD display, D-LCC10A/W

Pin No.	I/O	Signal	Notes
1	I	Dirty Ground	
2	I	Intensity	
3	I	Hsync2	horiz. Deflect
4	I	Vsync2	vert. Deflect
5	I	Contrast	
6	I	+32 Vdd	
7	I	GND	
8	O	RXDD RS232	from keyboard
9	I	TXDD RS232	to keyboard
10	I	ON/STBY	active GND
A1	I	BLUE GND & BLUE VIDEO 2	
A2	I	GREEN GND & GREEN VIDEO2	
A3	I	RED GND & RED VIDEO2	

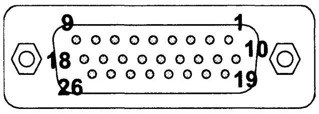


Table 4 Connector on LCD display, D-LCC12A

Pin No.	I/O	Signal	Notes
1	O	RED_VIDEO	Analog RGB to CRT
2	O	GREEN_VIDEO	
3	O	BLUE_VIDEO	
4	I	MON2ID0	
5	I	MON2ID1	
6	P	GND	
7	I	MON2ID0	
8	O	HSYNC2	
9	O	VSYNC2	
10	G	GND	
11	G	GND	
12	G	GND	
13	G	GND	
14	G	GND	

15	P	+5V	+5V to ComBar
16	I	ON_STBY	ON / StandBy signal from ComBar
17	G	GND	
18	G	GND	
19	I	RXDD	Serial data to/from ComBar
20	O	TXDD	
21	O	BRIGHTNESS	
22	O	CONTRAST	
23	O	NC	
24	O	NC	
25	PO	+32VD	Power supply for 10" display
26	PO	+32VD	

Table 5 Connector on D-LCC15 Rev.00-02 and on D-VMC15, on D-VNC15 and on D-VHC17

Pin No.		**Signal**	
1	<-	RV	Red
2	<-	GV	Green
3	<-	BV	Blue
4	->	ID2	Monitor Identification (LG)
5	<-	ST	Self test
6	<-	RG	Ground (red)
7	<-	GG	Ground (green)
8	<-	BG	Ground (blue)
9	-	-	-
10	-	LG	Ground (logic)
11	->	ID0	Monitor Identification (LG)
12	->	ID1	Monitor Identification
13	<-	HS	Horizontal sync.
14	<-	VS	Vertical sync.
15	-	-	Not used

Connectors on D-LCC15 Rev.03, D-LCC17 and D-LCC19

Information on the connectors can be found in the literature included with the display.

Connectors on D-MMP42 and D-MMP43

Information on the connectors can be found in the literature included with the display.

2.5 Display Controller Boards

2.5.1 Display Controller Boards, B-DISP and B-DISP19

B-DISP and B-DISP19 boards are connected to the CPU Mother board. The processor on the CPU board transmits programs through the CPU bus to the B-DISP and B-DISP19 boards.

B-DISP and B-DISP19 boards include the functions of the B-DHIGH and B-DVGA boards. Thus, B-DISP and B-DISP19 boards support also high resolution and VGA resolution.

NOTE: The B-DISP and B-DISP19 boards require monitor software S-xxx96 or later for operation. The XGA resolution setting requires monitor software S/L-xxx99, or later. If the B-DISP or B-DISP19 board is used to drive D-VHC14 display, a small part of the resulting picture will be clipped.

System memory

The system memory contains the GSP software code. The memory consists of two 256k x16 memory banks.

Frame memory

The frame memory contains digital display data. The size of the memory is 1 MB making 1984 x 512 display resolution with 256 colors possible. The memory consists of four 256k x 8 VRAM memory circuits.

Video interface palette

The video interface palette reads the digital display data from the frame memory and converts the data into analog RGB-signals. The synchronization signals for the conversion are generated by the GSP.

The video interface palette is clocked by two pixel clocks. A 25 MHz clock is selected for VGA resolution and a 40 MHz clock is selected for high resolution. The 40 MHz clock is internally converted into an 80 MHz clock.

Graphics System Processor (GSP)

There are four 16-bit registers in the GSP, from which the host-processor reads and to which it writes data.

Display Controller Resolution

The resolution of the display controller depends on the initialization of the GSP's registers and the frequency of the video oscillator.

Reset Signal

The reset signal comes from the power supply unit through the CPU bus.

Monitor ID register

The monitor ID register contains a three-bit (numeric values 0-7) monitor ID code. The register is connected to channels 11-13 of the X3 D-connector. If no display is connected to B-DISP board or if the monitor ID code fails, 111 code is generated by pull-up resistors. If the ID code is 011 or 101, VGA resolution is selected, otherwise high resolution is selected.

NOTE: Automatic resolution setting applies only to monitor software versions S-xxx96, S-xxx97, S-xxx98 and later.

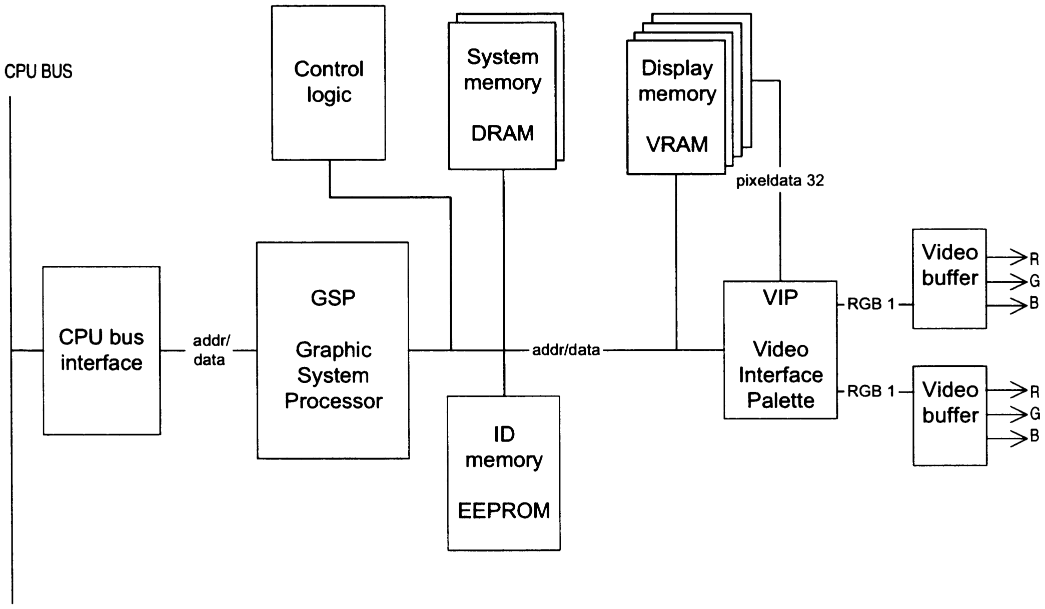

CPU BUS
Control logic
System memory
DRAM
Display memory
VRAM
pixeldata 32
CPU bus interface
addr/ data
GSP
Graphic System Processor
addr/data
ID memory
EEPROM
VIP
Video Interface Palette
RGB 1
RGB 1
Video buffer
Video buffer
R
G
B
R
G
B

Figure 3 **Display Controller Boards, B-DISP and B-DISP19, block diagram**

2.5.2 Connectors and signals

Table 6 **15-pin D-connector on Display Controller Board, B-DISP and B-DISP19, X2**

Pin No.	I/O	Signal	Note
1	O	RED VIDEO 1	analog
2	O	GREEN VIDEO 1	analog
3	O	BLUE VIDEO 1	analog
4		MON1ID2	monitor identification
5	O	GND	
6	O	RED GND	
7	O	GREEN GND	
8	O	BLUE GND	
9		N/C	
10	O	SYNC GND	
11		MON1ID0	monitor identification
12		MON1ID1	monitor identification
13	O	HSYNC 1	TTL, CMOS
14	O	VSYNC 1	TTL, CMOS
15		N/C	

Table 7 26-pin D-connector on Display Controller Board, B-DISP and B-DISP19

Pin No.	I/O	Signal
1	0	Red video (analog)
2	0	Green video (analog)
3	0	Blue video (analog)
4	I	MON2ID2
5	I	MON2ID1
6	0	Ground
7	I	MON2ID0
8	0	Horizontal sync
9	0	Vertical sync
10	0	Red ground
11	0	Green ground
12	0	Blue ground
13	0	Ground
14	0	Ground/Sync ground
15	0	+5 V
16	I	ON/STBY
17	0	Ground
18	0	Ground
19	I	RxD RS232
20	0	TxD RS232
21	0	Brightness
22	0	Contrast
23	0	Audbufout
24		Not connected
25	0	+32 Vd
26	0	+32 Vd

2.5.3 Display Controller Board, B-DISPX

B-DISPX board is connected to the CPU Mother board. The processor on the CPU board transmits programs through the CPU bus to the B-DISPX board, if needed.

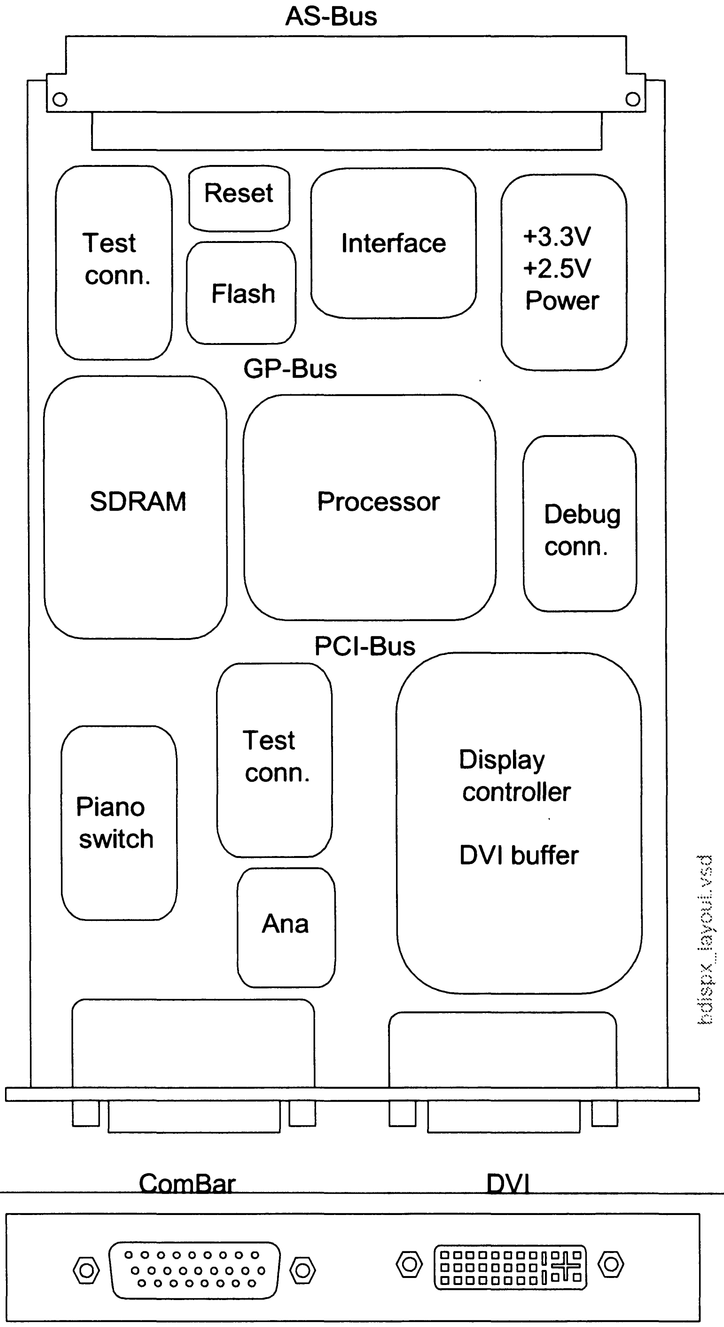

AS-Bus
Test conn.
Reset
Flash
Interface
+3.3V
+2.5V
Power
GP-Bus
SDRAM
Processor
Debug conn.
PCI-Bus
Piano switch
Test conn.
Ana
Display controller
DVI buffer
bdispx_layout.vsd
ComBar
DVI

Figure 4 **Display Controller Board, B-DISPX layout**

NOTE: B-DISPX requires monitor software L-ANE03, L-ANE03A revision 03 and later (if available) or L-ICU03 and L-ICU03A revision 03 and later (if available)

Description of functional blocks

Processor

The graphics processor on B-DISPX is 486 based embedded processor. It uses 133MHz clock frequency.

System memory

System Memory is a SDRAM memory. The display board software and fonts are loaded to this memory during the operation of the display controller board. SDRAM serves also as a temporary storage for image data.

The processor reads SDRAM by 66MHz clock frequency.

Flash

Flash memory is written to the SDRAM memory.

If the display controller software in the Flash memory is of an older version than the corresponding part in the monitor software, or if the Flash memory is empty, the display controller software is written from the main CPU to the display controller Flash memory during start-up.

Display controller

The actual image to be displayed is formed in the Display controller memory according to the data sent by the main CPU. The display controller then sends the image to the display(s) both in analog and in digital (DVI) form.

DAC

The two outputs through this digital-analog converter are for future use.

FPGA

FPGA is used for interfacing the image data packages from the main CPU to the display controller processor (through SDRAM) and further to the Display controller part image memory.

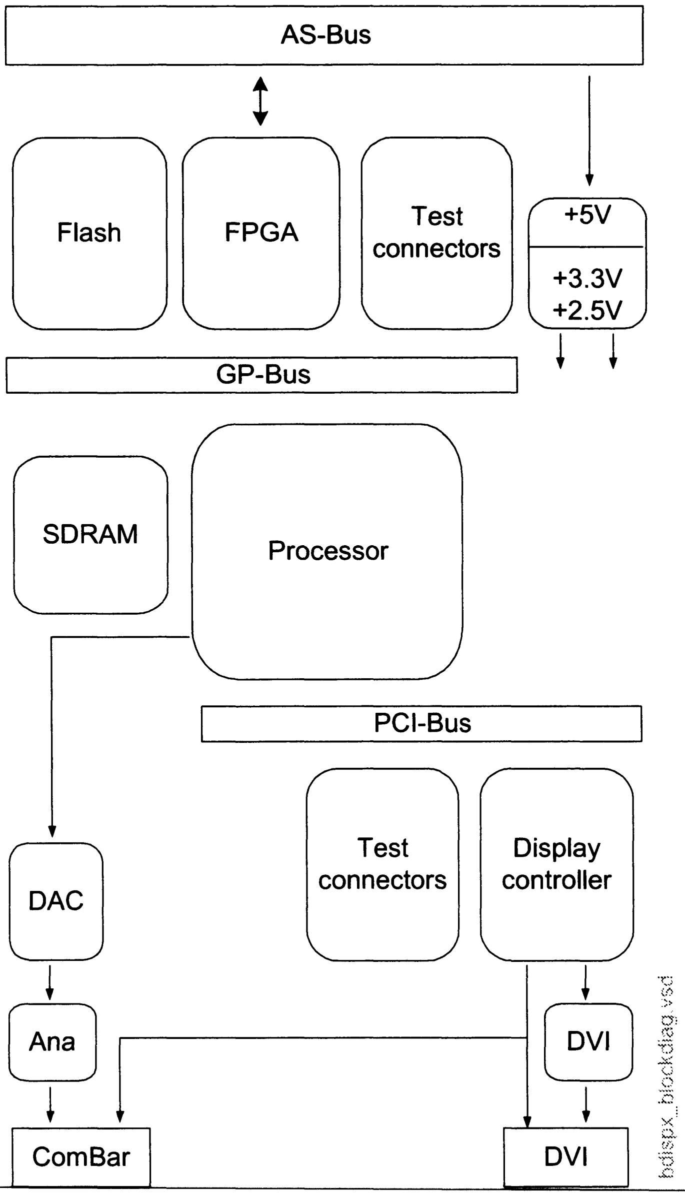

AS-Bus
Flash
FPGA
Test connectors
+5V
+3.3V
+2.5V
GP-Bus
SDRAM
Processor
PCI-Bus
DAC
Test connectors
Display controller
Ana
DVI
ComBar
DVI
bdispx_blockdiag.vsd

Figure 5 **B-DISPX block diagram**

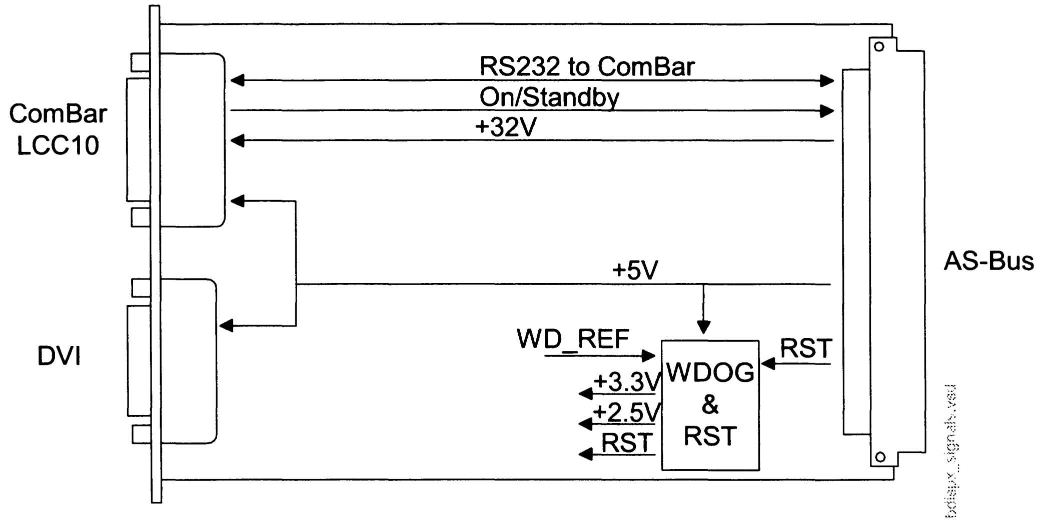

ComBar
LCC10
DVI
RS232 to ComBar
On/Standby
+32V
+5V
WD_REF
+3.3V
+2.5V
RST
WDOG
&
RST
RST
AS-Bus
bdispx_signals.vsd

Figure 6 **B-DISPX signals**

Watchdog

Reset circuitry must generate system reset if watchdog is not refreshed within 2.5 sec.

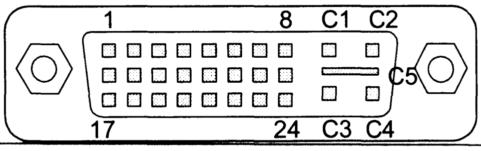
Master reset

System reset must be generated if master reset goes low. System reset must stay active 1100ms after supply voltages have reached valid levels.

DVI interface

Differential RGB data and clock links must operate according to DVI standard. +5V (±5% @ 100mA) voltage must be provided to DVI connector through current limitation circuitry.

2.5.4 Output connectors, B-DISPX

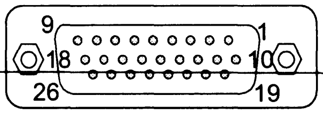

1
8
C1
C2
C5
17
24
C3
C4

DVI-interface

Pin		DIR	Level	Type	Description
1	TX2-	O	TMDS	DIF	Differential data to display
2	TX2+	O	TMDS	DIF	
3	2/4_SHIELD	G	GND		Shield for data pairs 2 & 4
4	TX4+	O	TMDS	DIF	Differential data to display
5	TX4-	O	TMDS	DIF	
6	DDC_CLOCK	O	OC	PU5	
7	DDC_DATA	I/O	OC	PU5	
8	ANA_VSYNC	O	CMOS		Vertical sync for analog display

Pin		DIR	Level	Type	Description
9	TX1-	O	TMDS	DIF	Differential data to display
10	TX1+	O	TMDS	DIF	
11	1/3_SHIELD	G	GND		Shield for data pairs 1 & 3
12	TX3-	O	TMDS	DIF	Differential data to display
13	TX3+	O	TMDS	DIF	
14	+5V_OUT	PO	+5V		+5V supply to display
15	GND	G	GND		
16	HP_DET	I	+5V		HotPlug detection
17	TXD0-	O	TMDS	DIF	Differential data to display
18	TXD0+	O	TMDS	DIF	
19	0/5_SHIELD	G	GND		Shield for data pairs 0 & 5
20	TX5-	O	TMDS	DIF	Differential data to display
21	TX5+	O	TMDS	DIF	
22	CLK_SHIELD	G	GND		Shield for CLK pair
23	CLK+	O	TMDS	DIF	Differential CLK to display
24	CLK-	O	TMDS	DIF	
C1	ANA_RED	O	ANA		Red, Green and Blue for analog display
C2	ANA_GREEN	O	ANA		
C3	ANA_BLUE	O	ANA		
C4	ANA_HSYNC	O	CMOS		Horizontal sync for analog display
C5	ANA_RETURN	G	GND		Return ground for analog interface

ComBar connector



ROW		DIR	Level	Type	Description	ROW
1	RED_VIDEO	O	ANA		Analog RGB to CRT	
2	GREEN_VIDEO	O	ANA			
3	BLUE_VIDEO	O	ANA			
4	MON2ID0	I	LVCMOS	PU3		pull-up 4.7k
5	MON2ID1	I	LVCMOS	PU3		pull-up 4.7k
6	GND	P	GND			
7	MON2ID0	I	LVCMOS	PU3		pull-up 4.7k

ROW		**DIR**	**Level**	**Type**	**Description**	**ROW**
8	HSYNC2	O	CMOS			
9	VSYNC2	O	CMOS			
10	GND	G	GND			
11	GND	G	GND			
12	GND	G	GND			
13	GND	G	GND			
14	GND	G	GND			
15	+5V	P	+5V		+5V to ComBar	
16	ON_STBY	I	+5V		ON / StandBy signal from ComBar	pass-through
17	GND	G	GND			
18	GND	G	GND			
19	RXDD	I	RS232	STD	Serial data to/from ComBar	pass-through
20	TXDD	O	RS232	STD		
21	BRIGHTNESS	O	ANA			
22	CONTRAST	O	ANA			
23	+2.5V_SENSE	O	+2.5V		+2.5V sense for unit tester	
24	+3.3V_SENSE	O	+3.3V		+3.3V sense for unit tester	
25	+32VD	PO	+32V		Power supply for 10" display	
26	+32VD	PO	+32V			

3 Service procedures

3.1 General service information

Field repair is limited to replacing parts that are listed in the corresponding spare part lists.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation and a detailed description of the fault.

CAUTION The tests and repairs outlined in this section should only be attempted by trained personnel with the appropriate equipment. Unauthorized service may void warranty of the unit.

3.1.1 Video Display, D-VMC15

Maintenance is limited to basic adjustments through the display's keys and to replacing mechanical parts of the display stand.

In case of a display failure, contact GE Healthcare for a possibility to repair the display at a local repair company.

The display can always be returned to GE Healthcare for repair.

3.1.2 Video Display, D-VNC15

Maintenance is limited to basic adjustments through the display's keys and to replacing mechanical parts of the display stand.

In case of a display failure, contact GE Healthcare for a possibility to repair the display at a local repair company.

The display can always be returned to GE Healthcare for repair.

3.1.3 Video Display, D-VHC17

Maintenance is limited to basic adjustments through the display's keys and to replacing mechanical parts of the display stand.

The display should be returned to GE Healthcare for repair.

3.1.4 Video Display, D-VSC21

Maintenance is limited to basic adjustments through the display's keys.

The display should be returned to GE Healthcare for repair.

3.1.5 LCD Display, D-LCC10A/W

The backlight tubes (2 pcs) are replaceable.

3.1.6 LCD Display, D-LCC12 A

The D-LCC12A contains a replaceable backlight.

3.1.7 LCD Display, D-LCC15

Maintenance is limited to basic adjustments through the display's keys.
The backlight tubes (2 pcs) are replaceable in some models.

3.1.8 LCD Display, D-LCC17

Maintenance is limited to basic adjustments through the display's keys.
The display should be returned to GE Healthcare for repair.

3.1.9 LCD Display, D-LCC19

Maintenance is limited to basic adjustments through the display's keys.
The display should be returned to GE Healthcare for repair.

3.1.10 Plasma Display, D-MMP42

Maintenance is limited to basic adjustments through the display's keys.

3.1.11 Plasma Display, D-MMP43

Maintenance is limited to basic adjustments through the display's keys.

3.2 Service check

These instructions include complete procedures for a service check. The service should be performed after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include check forms, which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check form should be signed after performing the procedure.

3.2.1 Video Display, D-VMC15

Tools needed

Central Unit, B-DISP or B-DISPX, parameter modules, keyboard (K-ANEB/K-ICUB)

Visual inspection

- Turn the monitor to STBY.

1. Cover and the picture tube

   Check that the display cover and the picture tube screen are intact.

   ✍

2. Power cord locking

   Check that the display power cord is locked to the display with a power cord guard.

   ✍

3. Power cord

   Disconnect the display power cord from the power supply unit and check that the connector pins are clean and straight. Check that the power cord is intact.
   Reconnect the power cord properly.

   ✍

4. Video cable

   Disconnect the display video cable from the used display controller board and check that the connector pins are clean and straight. Check that the video cable is intact. Check that the thumbscrews on the video cable connector are intact.
   Reconnect the video cable and lock it properly.

   ✍

Functional inspection

5. Power ON LED

   Turn the monitor on. Check that the power-on indicator LED on the display front panel lights up.

   ✍

- Prepare the picture for adjustments by pushing the **HELP** key on the Command Board and removing one of the connected plug-in modules from the Central Unit. Wait until the message regarding the removed module appears on the monitor screen.

  Remove the keyboard (K-ANEB or K-ICUB)

6. Contrast and brightness adjustments

   Check that the contrast of the colors is changing with the contrast control knob. Leave the adjustment to a suitable level.

   Perform the same steps also for BRIGHTNESS.

   ✍

7. Position adjustments

   Go to MAIN MENU (First push button on the left) and select GEOMETRY and vertical centring ~~(See function of push button on the screen).~~

   Check that the vertical centring of the picture is changing with the keys + and -. Leave the adjustment to a suitable level.

   Perform the same steps also for horizontal centring, height and width.

   Go back to MAIN MENU

   ✍

8. Color temperature adjustments

   Select COLOR and COLOR TEMPERATURE.

   Check that the colors on the screen are changing with the keys + and -. Leave the adjustment to a suitable level.

Perform the same steps also for RED and BLUE.

✍

9. Light sensor

   Select SPECIAL on MAIN MENU. Check that the light sensor is ON.

   Cover the hole on the right side of the screen with your finger and wait a few seconds. Check that the contrast on the screen changes and remove your finger. Check that the contrast on the screen changes back to normal.

   Go back to the normal screen.

   ✍

10. Electrical safety test

    Perform an electrical safety check and a leakage current test.

    ✍

11. Functioning after safety test

    Check that the display functions normally after the performed electrical safety check.

    ✍

12. Final cleaning

    Clean the picture tube with a clean, soft cloth dampened with suitable cleaning solution.

    NOTE: Do not use any abrasives or hard objects to remove stains. Do not polish the screen.

    Clean the display cover with a cloth dampened with a mild detergent solvent.

    NOTE: Do not use strong solvents (e.g. acetone) or aerosol cleaners for cleaning the cover.

    ✍

- Fill in all necessary documents.

3.2.2 Video Display, D-VNC15

Tools needed

Command Board, Central Unit, B-DISP or B-DISPX, parameter modules

Visual inspection

- Turn the monitor to STBY.

1. Cover and the picture tube

   Check that the display cover and the picture tube screen are intact.

   ✍

2. Power cord locking

   Check that the display power cord is locked to the display with a power cord guard.

   ✍

3. Power cord

   Disconnect the display power cord from the power supply unit and check that the connector pins are clean and straight. Check that the power cord is intact.

   Reconnect the power cord properly.

   ✍

4. Video cable

   Disconnect the display video cable from the display controller board and check that the connector pins are clean and straight. Check that the video cable is intact. Check that the thumb screws on the video cable connector are intact.

   Reconnect the video cable and lock it properly.

   ✍

Functional inspection

5. Power ON LED

   Turn the monitor on. Check that the power-on indicator LED on the display front panel lights up.

   ✍

- Prepare the picture for adjustments by pushing the **HELP** key on the Command Board and removing one of the connected plug-in modules from the Central Unit. Wait until the message regarding the removed module appears onto the monitor screen.

6. Position adjustments

   Select VERT CENTRING with the keys SELECT and ADJUST.

   Check that the vertical centring of the picture is changing with the ADJUST keys. Leave the adjustment to a suitable level.

   Perform the same steps also for HOR CENTRING.

   ✍

7. Size adjustments

   Select HEIGHT.

   Check that the height of the picture is changing with the ADJUST keys. Leave the adjustment to a suitable level.

   Perform the same steps also for WIDTH.

   ✍

8. Shape adjustments

   Select PINCUSHION.

   Check that the shape of the picture is changing with the ADJUST keys. Leave the adjustment to a suitable level.

   Perform the same steps also for TRAPEZOID and ORTHOGONALITY.

   ✍

9. Tilt adjustment

   Select TILT.

   Check that tilting of the picture is changing with the ADJUST keys.. Leave the adjustment to a suitable level.

   ✍

10. Degaussing

    Select DEGAUSSING with the SELECT keys then push the key ADJUST (+) or (>). Check that the picture on the screen sways briefly with a subdued sound

    NOTE: Degaussing (demagnetisation) takes place automatically when the monitor is turned on. The efficiency of a single degaussing phase decreases if repeated at intervals shorter than 15 minutes.

    ✍

11. Color temperature adjustments

    Select COLOR or COLOR TEMPERATURE with the SELECT and ADJUST keys.

    Check that the colors on the screen are changing with the ADJUST keys. Leave the adjustment to a suitable level.

    Perform the same steps also for RED, BLUE and GREEN (the last adjustment only in Rev. 00-02 displays).

    ✍

12. Contrast mode selection

    Select CONTRAST MODE.

    Check that the contrast mode is turning on and off with the ADJUST keys. Leave the selection into a suitable mode.

    ✍

13. Electrical safety test

    Perform an electrical safety check and a leakage current test.

    ✍

14. Functioning after safety test

    Check that the display functions normally after the performed electrical safety check.

    ✍

15. Final cleaning

    Clean the picture tube with a clean, soft cloth dampened with suitable cleaning solution.

    NOTE: Do not use any abrasives or hard objects to remove stains. Do not polish the screen.

    Clean the display cover with a cloth dampened with a mild detergent solvent.

NOTE: Do not use strong solvents (e.g. acetone) or aerosol cleaners for cleaning the cover.

✍

- Fill in all necessary documents.

3.2.3 Video Display, D-VHC17

Tools needed

Command Board, Central Unit, B-DISP or B-DISPX, and parameter modules

Visual inspection

- Turn the monitor to STBY.

1. Cover and the picture tube

   Check that the display cover and the picture tube screen are intact.

   ✍

2. Power cord locking

   Check that the display power cord is locked to the display and display tray with a power cord guard.

   ✍

3. Power cord

   Disconnect the mains power cord from the display tray. Check that the pins on the display tray connector are clean and straight. Check that the power cord is intact.

   ✍

   Leave the power cord disconnected.

4. Fuses and fuse holders

   Detach the primary fuse holder from the mains power receptacle. Check that the fuse compartment, the fuse holder and the fuses are clean and intact. Check also that the fuses are of the correct rating.

   Check also the secondary fuse, the secondary fuse holder and compartment.

   Reattach the fuses properly and reconnect the mains power cord.

   ✍

5. Video cable

   Disconnect the display video cable from the display controller board and check that the connector pins are clean and straight. Check that the video cable is intact. Check that the thumb screws on the video cable connector are intact.

   Reconnect the video cable and lock it properly.

   ✍

Functional inspection

6. Power ON LED

   Turn the monitor on. Check that the power-on indicator LED on the display front panel lights up (the display power switch should be in ON position).

   ✍

- Prepare the picture for adjustments by pushing the **HELP** key on the Command Board and removing one of the connected plug-in modules from the Central Unit. Wait until the message regarding the removed module appears on the monitor screen.

7. Contrast and brightness adjustments

   Activate the contrast adjustment by pushing the ADJUST (-) or ADJUST (+) key.

   NOTE: When the function LED is lit up, push the FUNCTION key before adjusting contrast and brightness.

   Check that the contrast of the colors is changing with the ADJUST (-) and ADJUST (+) keys. Leave the adjustment to a suitable level.

   Perform the same steps for brightness adjustment with the SELECT (-) and SELECT (+) keys.

   NOTE: The contrast and brightness adjustments are stored automatically after 15 seconds from the last change.

   ✍

8. Position adjustments

   Press the FUNCTION key. Select the horizontal position adjustment by pushing the SELECT (-/+) key. Adjust the position by pushing the ADJUST (-/+) key. Store the adjustment by pushing the STORE key.

   Adjust the vertical position correspondingly.

   ✍

9. Size adjustments

   Press the FUNCTION key. Select the horizontal size adjustment by pushing the SELECT (-/+) key. Adjust the size by pushing the ADJUST (-/+) key. Store the adjustment by pushing the STORE key.

   Adjust the vertical size correspondingly.

   ✍

10. Shape adjustments

    Press the FUNCTION key. Select the pincushion adjustment by pushing the SELECT (-/+) key. Adjust the pincushion by pushing the ADJUST (-/+) key. Store the adjustment by pushing the STORE key.

    Adjust the trapezoid correspondingly.

    ✍

11. Rotation adjustment

    Press the FUNCTION key. Select the rotation adjustment by pushing the SELECT (-/+) key. Adjust the rotation by pushing the ADJUST (-/+) key. Store the adjustment by pushing the STORE key.

    ✍

12. Degaussing

    Press the DEGAUSS key. Check that the picture on the screen sways briefly with a subdued sound.

    NOTE: Degaussing (demagnetisation) takes place automatically when the monitor is turned on. The efficiency of a single degaussing phase decreases if repeated at intervals shorter than 10 minutes.

    ✍

13. Color adjustments

    Press the FUNCTION key. Select the color adjustments by pushing the SELECT (-/+) key. Adjust the colors by pushing the ADJUST (-/+) key. Store the adjustments by pushing the STORE key.

    ✍

14. Electrical safety test

    Perform an electrical safety check and a leakage current test.

    ✍

15. Functioning after safety test

    Check that the display functions normally after the performed electrical safety check.

    ✍

16. Final cleaning

    Clean the picture tube with a cloth dampened with isopropyl alcohol.

    NOTE: Do not use water with any kind of detergent for cleaning the picture tube. Do not use any abrasives or hard objects to remove stains.

    Clean the display cover with a cloth dampened with a mild detergent solvent.

    NOTE: Do not use strong solvents (e.g. acetone) or aerosol cleaners for cleaning the cover.

    ✍

- Fill in all necessary documents.

3.2.4 Video Display, D-VSC21

Tools needed

Command Board, Central Unit, B-DISP or B-DISPX and parameter modules

Visual inspection

- Turn the monitor to STBY.

1. Cover and the picture tube

   Check that the display cover and the picture tube screen are intact.

   ✍

2. Screws

   Check that all display screws are tightened properly.

   ✍

3. Power cord

   Check that the display power cord is intact.

   ✍

4. Video cable

   Disconnect the display video cable from the Display controller board and check that the connector pins are clean and straight. Check that the thumbscrews on the video cable connector are intact.

   Reconnect the video cable and lock it properly.

   ✍

Functional inspection

- Make sure that the display has been powerless for at least two minutes, then turn the monitor on.

5. Position adjustments

   Check that the picture on the display screen is positioned correctly. Readjust the picture position, if necessary.

   ✍

6. Brightness and contrast

   Check that the brightness and contrast are adjusted correctly. Readjust them, if necessary.

   ✍

7. Colors

   Check that all the colors on the screen are clear.

   NOTE: Internal degaussing (demagnetisation) for clearing the colors takes place automatically when the monitor is turned on.

   If necessary, perform extra degaussing using an external degaussing coil.

   ✍

8. Electrical safety test

   Perform an electrical safety check and a leakage current test.

9. Functioning after safety test

   Check that the display functions normally after the performed electrical safety check.

10. Final cleaning

    Clean the picture tube with a cloth dampened with isopropyl alcohol.

    NOTE: Do not use water with any kind of detergent for cleaning the picture tube. Do not use any abrasives or hard objects to remove stains.

    Clean the display cover with a cloth dampened with a mild detergent solvent.

    NOTE: Do not use strong solvents (e.g. acetone) or aerosol cleaners for cleaning the cover.

- Fill in all necessary documents.

3.2.5 LCD Display, D-LCC10A, Workstation LCD Display, D-LCC10W

Tools needed

Central Unit, B-DISP / B-DVGA, a multiparameter hemodynamic module, Anesthesia Keyboard, K-ARK, K-ARK - D-LCC10 Interface cable (Order code 881154) and a screwdriver

Visual inspection

1. Cable

   Disconnect and check the LCD display interface cable.

   Check the monitor side connector:

   - the connector pins are clean and straight and at about the same height
   - the locking screws are intact

   Check the display side connector:

   - the screw(s) on the casing is tightened properly
   - the connector pins are clean and intact
   - the locking screws/claws are intact

   Check also that the cable itself is intact.

   Leave the cable disconnected.

2. Internal parts

   Detach the rear cover by removing the four screws from the corners.

   Check internal parts:

   - all screws are tightened properly

- all cables are connected properly
- all IC's that are on sockets are attached properly
- there are no loose objects inside the display

Reattach the rear cover.

3. External parts

Check the external parts:

- the outer cover is intact
- the display screen is intact
- the front panel stickers are intact
- the ComWheel cover is intact and is attached properly
- the ON/STBY switch and its protector are intact and attached properly
- the anesthesia keyboard connector is clean and intact
- the LCD interface cable connector is clean and intact
- the block screws for the cable are in place and tightened properly (if installed)
- the block screw threads are intact (if installed)

Functional inspection

4. ON/STBY switch

Check that the ON/STBY switch changes its state firmly when switching it back and forth. Leave the switch into STBY position.

- Turn the monitor to stand-by. Install the hemodynamic module to the Central Unit.
- Connect and lock the LCD interface cable to the LCD display and to the B-DISP/B-DVGA in the monitor.

5. Stand-by LED

Check that the stand-by LED on the LCD display front panel is lit up (the monitor power cord is connected to the mains).

- Turn the LCD display ON/STBY switch to ON.

6. LCD display picture

Wait until the normal monitoring screen appears on the LCD display. Check that the picture on the LCD display screen is clear and stable. Check also that all the colors are clear.

7. Keyboard software

Enter the service menu:

Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

Take down the information regarding LCD display keyboard software.

✍

8. Alarm LEDs

   Select ***KEYBOARD*** - ***UPPER LED***. Check that the red alarm LED is turning on and off on the LCD display when pressing the ComWheel. Check also the yellow alarm LED by selecting ***LOWER LED*** from the menu.

   ✍

9. Membrane keys

   Check the LCD display membrane keys.

   Press the keys on the LCD display front panel one by one. Check that each key generates a sound from the loudspeaker and the corresponding text in the menu changes from yellow to red.

   ✍

10. Check the ComWheel

    Turn the ComWheel clockwise and counter clockwise and check that each step generates a sound from the loudspeaker and the corresponding values at the bottom of the menu increase. Select ***DUMMY PRESS*** and check that the press generates a sound and the corresponding value in the menu increases.

    ✍

- Turn the LCD display ON/STBY switch to STBY. Connect the Anesthesia Keyboard to the LCD display side panel connector with the interface cable, order code 881154.

11. Anesthesia keyboard interface

    Turn the monitor back on and check that the Anesthesia Keyboard functions normally through the LCD display.

    ✍

12. Electrical safety check

    Perform an electrical safety check and a leakage current test.

    ✍

13. Functioning after safety check

    Check that the LCD display functions normally after the performed electrical safety check.

    ✍

14. Final cleaning

    Clean the LCD display with suitable detergent.

    ✍

- Fill in all necessary documents.

3.2.6 LCD Display, D-LCC12A

Tools needed

Central Unit, B-DISP or B-DISP19 or B-DISPX and a screwdriver

Visual inspection

1. Interface cable

   Disconnect and check the LCD display interface cable:

   The monitor side connector:
   - the connector pins are clean and straight and at about the same height
   - the locking screws are intact

   The display side connector:
   - the screw(s) on the casing is tightened properly
   - the connector pins are clean and intact
   - the locking screws/claws are intact

   Check also that the cable itself is intact.

   Detach the rear cover by removing the eight screws from the corners.

2. Check internal parts
   - all screws are tightened properly
   - all cables are connected properly
   - all IC™s that are on sockets are attached properly
   - there are no loose objects inside the display

   Reattach the rear cover.

3. Check external parts
   - the outer cover is intact
   - the display screen is intact
   - the block screws for the cable are in place and tightened properly (if installed)
   - the block screw threads are intact (if installed)

Functional inspection

4. Check the picture

   Check that the picture on the LCD display screen is clear and stable.

   Check also that the colors are clear.

   NOTE: Check that the display screen uses the SVGA mode.

   NOTE: The SVGA resolution must be set every time after Factory Reset.

Display Setup - ***Install/Service*** (password 16-4-34) ***Installation***

Note: After changing the resolution, the monitor must be restarted before the setting becomes active.

✍

5. Keyboard software

   Enter the service menu:

   Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

   Take down the information regarding the LCD display keyboard software.

   ✍

   Select ***KEYBOARD*** - ***UPPER LED***.

6. Check the alarm LEDs

   Check that the red alarm LED is turning on and off on the LCD display when pressing the ComWheel.

   Check also the yellow alarm LED by selecting ***LOWER LED*** from the menu.

   ✍

7. Membrane keys

   Check the LCD display membrane keys.

   Press the keys on the LCD display front panel one by one.

   Check that each key generates a sound from the loudspeaker and the corresponding text in the menu changes from yellow to red.

   ✍

8. Check the ComWheel

   Turn the ComWheel clockwise and counter clockwise and check that each step generates a sound from the loudspeaker and the corresponding values at the bottom of the menu increase.

   Select ***DUMMY PRESS*** and check that the press generates a sound and the corresponding value in the menu increases.

   ✍

9. Electrical safety check

   Perform an electrical safety check and a leakage current test.

   ✍

10. Functioning after safety check

    Check that the LCD display functions normally after the performed electrical safety check.

    ✍

11. Final cleaning

    Clean the LCD display with suitable detergent.

✍

- Fill in all necessary documents.

3.2.7 LCD Display, D-LCC15

Tools needed

Central Unit, B-DISP, B-DISP19 or B-DISPX, Keyboard, K-ANEB/ K-ICUB and a screwdriver

Visual inspection

1. Interface cable

   Disconnect and check the LCD display interface cable.

   The monitor side connector:

   - the connector pins are clean and straight and at about the same height
   - the locking screws are intact

   The display side connector:

   - the screw(s) on the casing is tightened properly
   - the connector pins are clean and intact
   - the locking screws/claws are intact

   Check also that the cable itself is intact.
   Leave the cable disconnected.

   ✍

2. Internal parts

   Detach the rear cover by removing the four screws under the gray pads and the two small black screws on the bottom (middle).

   Check internal parts:

   - all screws are tightened properly
   - all cables are connected properly
   - all IC's that are on sockets are attached properly
   - there are no loose objects inside the display

   Reattach the rear cover.

   ✍

3. External parts

   Check external parts:

   - the outer cover is intact
   - the display screen is intact
   - the block screws for the cable are in place and tightened properly (if installed)
   - the block screw threads are intact (if installed)

   ✍

Functional inspection

4. Interface cable and power cord

   Connect and lock the LCD interface cable to the LCD display and to the display controller board in the monitor.

   Check that the display power cord is intact and properly in place.

- Turn the monitor ON/STBY switch to ON

  ✍

5. Display mode

   Wait until the normal monitoring screen appears on the LCD display.

   Check that the picture on the LCD display screen is clear and stable.

   NOTE: Check that the display screen uses the XGA mode.

   Install/Service (password 16-4-34) ***- Installation - Display Setup***

   Note: After changing the resolution, the monitor must be restarted before the setting becomes active.

   ✍

6. Brightness and contrast adjustments

   NOTE: The control keys can be unlocked/locked by pressing the -, + and ∨ keys simultaneously.

   Go to MAIN MENU (press the ∧ or ∨ key on the right side of the display front panel) and select BASIC SETTING.

   Select CONTRAST and check that the contrast of the colors is changing with the + and - keys. Leave the adjustment to a suitable level.

   Perform the same steps also for BRIGHTNESS.

   ✍

7. Position adjustments

   Go to MAIN MENU and select POSITION and vertical position (V- POSITION).

   Check that the vertical position of the picture is changing with the + and - keys. Leave the adjustment to a suitable level.

   Perform the same steps also for horizontal position.

   Go back to MAIN MENU.

   ✍

8. Color temperature adjustments

   Select COLOR TEMP MENU and USER.

   Check that the colors on the screen are changing with the keys + and -. Leave the adjustment to a suitable level.

   Go back to the normal screen.

   ✍

9. Electrical safety check

   Perform an electrical safety check and a leakage current test.

10. Functioning after safety check

    Check that the LCD display functions normally after the performed electrical safety check.

11. Final cleaning

    Clean the LCD display with suitable detergent.

- Fill in all necessary documents.

3.2.8 LCD Display, D-LCC17 and D-LCC19

Tools needed

Central Unit, B-DISP19 or B-DISPX, Keyboard K-ANEB/K-ICUB and a screwdriver

Visual inspection

1. Interface cable

   Disconnect and check the LCD display interface cable:

   The monitor side connector:
   - the connector pins are clean and straight and at about the same height
   - the locking screws are intact

   The display side connector:
   - the screw(s) on the casing is tightened properly
   - the connector pins are clean and intact
   - the locking screws/claws are intact

   Check also that the cable itself is intact.

2. Check external parts
   - the outer cover is intact
   - the display screen is intact
   - the block screws for the cable are in place and are tightened properly (if installed)
   - the block screw threads are intact (if installed)

Functional inspection

3. Power cord

   Connect and lock the LCD interface cable to the LCD display and to the display controller board in the monitor.

   Check that the display power cord is intact and properly in place.

   – Turn the monitor ON/STBY switch to ON

   ✍

4. LCD display picture

   Wait until the normal monitoring screen appears onto the LCD display.

   Check that the picture on the LCD display screen is clear and stable.

   NOTE: Check that the display screen uses the XGA (with B-DISP19) or SXGA (with B-DISPX) mode.

   NOTE: The SXGA resolution must be set every time after Factory Reset.

   Install/Service (password 16-4-34) **- *Installation*** - ***Display setup***

   NOTE: After changing the resolution, the monitor must be restarted before the setting becomes active.

   ✍

5. Contrast and brightness adjustments

NOTE: The control keys can be unlocked/ locked by pressing the v , - and + keys (D-LCC17) or the middle keys (D-LCC19, not available in all display types) simultaneously.

   Perform the contrast and brightness adjustments if needed. Please refer to the display's Operators Manual.

   ✍

6. Position adjustments

   Perform the vertical and horizontal adjustments if needed. Please refer to the display's Operators Manual.

   ✍

7. Color temperature adjustments

   Perform the color adjustments if needed. Please refer to the display's Operators Manual.

   Go back to the normal screen.

   ✍

8. Electrical safety check

   Perform an electrical safety check and a leakage current test.

   ✍

9. Functioning after safety check

   Check that the LCD display functions normally after the performed electrical safety check.

10. Final cleaning

    Clean the LCD display with suitable detergent.

- Fill in all necessary documents.

3.2.9 Plasma Display, D-MMP42 and D-MMP43

Tools needed

Central Unit, B-DISP, B-DISP19 or B-DISPX, Keyboard K-ANEB / K-ICUB and screwdriver

Visual inspection

1. Interface cable

- Disconnect and check the plasma display interface cable:

  The monitor side connector:

  - the connector pins are clean and straight and at about the same height
  - the locking screws are intact

  The display side connector:

  - the screw(s) on the casing is tightened properly
  - the connector pins are clean and intact
  - the locking screws/claws are intact

  Check also that the cable itself is intact.

2. External parts

   Check that:

   - the outer cover is intact
   - the display screen is intact
   - the block screws for the cable are in place and tightened properly (if installed)
   - the block screw threads are intact (if installed)

Functional inspection

3. Power cord

   Connect and lock the display interface cable to the plasma display and to the display controller board in the monitor.

   Check that the display power cord is intact and properly in place.

- Turn the monitor ON/STBY switch to ON.

✍

4. Check the picture

   Wait until the normal monitoring screen appears on the display. Check that the picture on the display screen is clear and stable.

   NOTE! Check that the display screen uses the XGA mode.

   Install/Service (password 16-4-34) - ***Installation - Display Setup***

   Note! After changing the resolution, the monitor must be restarted before the setting becomes active.

   ✍

5. Contrast and brightness adjustments

   Perform the contrast and brightness adjustments if needed. Please refer to the display's Operators Manual.

   ✍

6. Position adjustments

   Perform the vertical and horizontal adjustments if needed. Please refer to the display's Operators Manual.

   ✍

7. Color temperature adjustments

   Perform the color adjustments if needed. Please refer to the display's Operators Manual. Go back to the normal screen.

   ✍

8. Electrical safety test

   Perform an electrical safety check and a leakage current test.

   ✍

9. Functioning after electrical safety check

   Check that the plasma display functions normally after the performed electrical safety check.

   ✍

10. Clean the plasma display

    Clean the plasma display with suitable detergent.

    ✍

- Fill in all necessary documents.

For service check procedures, refer also to the literature included with the display.

3.3 Disassembly and reassembly

3.3.1 LCD Display, D-LCC10, D-LCC10 A/W

Disassemble the LCD Display according to the following procedure. Please refer to the exploded view of the LCD Display.

NOTE: Wear a static control wrist strap and soft cotton gloves (dust free) when handling the LCD Display parts. Do not touch connector pins.

1. Place the LCD Display on a flat surface with the front side downwards.
2. Remove the screws (4 pcs) that are located at the corners of the rear panel.
3. Lift the rear panel gently, disconnect the cable(s) and set the rear panel aside.

D-LCC10 (Rev. 03, 04), D-LCC10 A/W

In normal circumstances it is very difficult to keep the LCD Display component and the LCD Display shield free of dust, when they are detached from the LCD Display frame. If dust particles remain on the LCD Display component and LCD Display shield surfaces, they may impair the quality of the picture on the screen.

In case you need to detach the LCD Display component for repair, you may return it to be repaired at GE Healthcare. If you can provide a dust free environment, follow the instructions below.

NOTE: If the LCD Display unit is broken, handle it carefully to avoid injury (the LCD Display component and the backlight lamp are made of glass). Wash your hands if you touched liquid crystal, which may flow out from a broken LCD Display component.

NOTE: Do not touch, push or rub the exposed soft polarizer. Keep the polarizer clean. In case of accidental mishandling, see the instructions following this chapter.

1. To detach the Adapter board and its insulation plate, disconnect the cable connectors and remove the screws (4 pcs).
2. Remove the screws (7 pcs) that are located at the back of the LCD Display unit.
3. The following parts can now be lifted off one by one:
   - the Adapter unit
   - the LCD Display component with the backlight
   - ~~the LCD Display shield~~
   - the EMC cover with the LCD Display gasket
4. To detach the Command board PCB, disconnect the cable connectors and remove the screws (3 pcs).

Replacing the Backlight Tubes, D-LCC10 (Rev. 03, 04), D-LCC10 A/W

1. Disconnect the folio cables (2 pcs) by opening the connector's front part in cable direction.
2. Disconnect the other cables from the LCD interface board.
3. Unscrew 5 screws and draw out the lid.
4. Detach the connector of the backlight tube from the inverter board.
5. Unfasten those two screws that hold the backlight tube and draw it out with the clamp.
   NOTE: Do not touch the backlight lamps with hands!
6. Locate the new backlight tube, fasten the screws, and connect the tube to the inverter board.

7. Attach all the parts, and make sure that the folio cables are connected properly. Make sure that the folio cables are at the bottom and straight before locking the connector.

Adapter board (892424) jumpers on D-LCC10A/W

The right position for jumper X3 is 2-3.

Position for jumper X13 according to cable length:

1-2	0.5...2.5 m
2-3	> 2.5...10.0 m

NOTE: If you change the cable to a long (10 m) or to a short (2.5 m or shorter) one, you may have to change the jumper setting inside the display cabin in order to get a clear picture. Let an authorised person do this.

3.3.2 LCD Display, D-LCC12A

NOTE: Wear a static control wrist strap and soft cotton gloves (dust free) when handling the LCD display parts. Hold them by their corners or edges. Do not touch the connector pins.

In normal circumstances it is very difficult to keep the LCD Display component and the display shield surfaces free of dust, when the LCD Display unit assembly is opened and they are exposed to room air. If dust particles remain on the LCD Display component and the display shield surfaces, they may impair the picture quality on the screen.

In case you need to detach the LCD Display component for repair, you may return it to be repaired at GE Healthcare. If you can provide a dust free environment, follow the instructions below.

See also the Exploded view of the LCD Display, D-LCC12A.

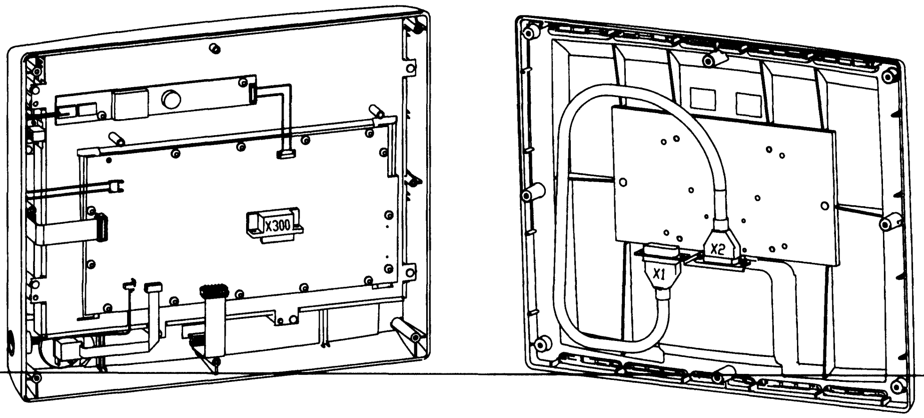


Figure 7 D-LCC12A inside view

1. Detach the display from the mount and disconnect the LCD interface cable at the display side.
2. Place the display carefully on a clean surface with the display screen side down.
3. Open the eight screws holding the display rear cover and detach the rear cover.
4. Open the two screws on the video cable connector and disconnect the video cable from the LCD Controller Board. Place the rear cover with the video cable aside.
5. Disconnect all other cables carefully from the LCD Controller Board.
6. Open the 14 screws holding the LCD Controller Board in the LCD Display Unit. Detach the LCD Controller Board carefully from the LCD Display Unit (connector X102 underneath connects to the LCD Display component).

7. Disconnect the backlight unit cables carefully from the Inverter Board. Open the six screws holding the LCD Display Unit metal frame in the display front cover. Detach the upper part of the metal frame.
8. Lift the LCD Display Unit together with the lower part of the metal frame carefully up and place it on a clean surface with the display screen side down.
9. Open the four screws holding the LCD Display Unit in the metal frame.
10. Lift the LCD Display Unit carefully up.

Reassembly of the display is made in reversed order. Make sure that all connectors are connected properly and cables are not pinched between covers.

NOTE! Do not use excessive force when fastening the LCD Display component to the metal frame. Fastening the screws too tightly might bend the display module too much and break it. The screws must also be fastened gradually: first fasten all screws slightly, then more tightly.

NOTE! When reassembling the LCD Display Unit, be careful that no dirt or fingerprints are left between the LCD Display component and the protection glass window.

NOTE: If the LCD Display Unit is broken, handle it carefully to avoid injury (the LCD Display component and the backlight lamp(s) are made of glass). Wash your hands if you touched liquid crystal, which may flow out from a broken LCD Display component.

NOTE: Do not touch, push or rub the exposed display module surface. Keep the surface clean.

Replacing the backlight unit

1. Detach the display from the mount and disconnect the LCD interface cable at the display side.
2. Place the display carefully on a clean surface with the display screen side down.
3. Open the eight screws holding the display rear cover and detach the rear cover.
4. Open the two screws on the video cable connector and disconnect the video cable from the LCD Controller Board. Place the rear cover with the video cable aside.
5. Disconnect all other cables carefully from the LCD Controller Board.
6. Open the 14 screws holding the LCD Controller Board in the LCD Display Unit. Detach the LCD Controller Board carefully from the LCD Display Unit (connector X102 underneath connects to the LCD Display component).
7. Disconnect the backlight unit cables carefully from the Inverter Board. Open the six screws holding the LCD Display Unit metal frame in the display front cover. Detach the upper part of the metal frame.
8. Lift the LCD Display Unit together with lower part of the metal frame carefully up and place it on a clean surface with the display screen side down.
9. Release the screw holding the backlight unit.

NOTE: The screw cannot be removed totally, only released.

10. Detach the backlight unit by sliding it to the left and then lifting up.

NOTE: Do not bend the backlight unit.

NOTE: Do not touch the backlight tubes with your hands.

Reassembly of the LCD Display is made in reversed order. Make sure that all connectors are connected properly and cables are not pinched between covers.

3.3.3 LCD Display, D-LCC15

Replacing the Backlight Tubes

1. Disconnect the display cables from the Central Unit and lift off the display together with the display stand.
2. Remove the hole covers and 6 screws from the back corners and bottom line of the display case. Separate the front panel from the back panel of the monitor.
3. Remove the 8 screws attaching the display case to the front display case. Take the display case out of the front cover and place it face down on a nonabrasive clean surface.
4. Locate the bulb replacement slots located on the same side as the display buttons. Remove the copper tape as necessary.
5. Turn the display over and remove the screw fastening the button circuit board to the display case.
6. Turn the display over and remove the screw fastening the slot cover to the display case.
7. Carefully free the wires from the display case to access the bulb connector. Separate the connector.
8. Locate the screw hole near the top removal slot on the back face of the display case. Remove the screw hole to free the bulb for replacement.
9. Pull the cable on the female side of the connector out of the display case and continue pulling until the bulb is completely removed.
10. Slide the new replacement backlights into slots on the side of the display case.

Reassembly of the LCD Display is made in reversed order. Make sure that all connectors are connected properly and cables are not pinched between covers.

3.3.4 LCD Display, D-LCC17

Do not disassemble.

3.3.5 LCD Display, D-LCC19

Do not disassemble.

3.3.6 Video Display, D-VMC15

Do not disassemble.

3.3.7 Video Display, D-VNC15

1. Disconnect the display cables from the Central Unit and lift off the display together with the display stand.
2. Detach the display by removing the screw from the bottom of the display stand.

NOTE: The display is not to be disassembled.

3. Reassembly is made in reversed order.

3.3.8 Video Display, D-VHC17

1. Disconnect the display signal cable from the Central Unit and the mains power cord from the display stand.

2. Lift off the display together with the display stand.
3. Detach the display from the display stand by disconnecting the display power cable and removing the four screws from the bottom of the stand.
4. Detach the display bracket by removing the screws from the bottom and then sliding it off.

NOTE: The display is not to be disassembled.

5. Reassembly is made in reversed order.

3.3.9 Video Display, D-VSC21

Do not disassemble.

3.3.10 Plasma Display, D-MMP42

Do not disassemble.

3.3.11 Plasma Display, D-MMP43

Do not disassemble.

4 Troubleshooting

4.1 Video Displays, D-VMC15, D-VNC15, D-VHC17, D-VSC21

Problem	**Indicator on the front panel**	**Treatment**
Picture screen is blank	The indicator on the front panel is not illuminated	Check that the power cord is correctly connected to the display and to the power outlet. Check that the monitor is turned on with the ON/STBY switch.
Picture screen is blank	The indicator on the front panel is illuminated	The display might be in stand-by position. Check that the signal cable connector is connected. If the connector is loose, tighten the connector's screws. Check the signal cable's connection pins. If the pins are slightly distorted, use nose pliers to straighten them.

Problem	**Treatment**
Picture has color defects	Demagnetize the monitor using the display's key/menus. If color defect is repeated without the monitor having been moved, it is possible that the monitor is influenced by a strong interference field (near to a high power cable, for example). Try to find a better location for the monitor or the interference source.
Picture is unreadable	Turn off the monitor for a moment. If the display remains unclear after the restart, the display may be out of synchronization. Try to locate the fault by replacing parts.
Picture is black and white	Check that the signal cable's connector is completely inserted. Turn off the monitor and restart.
'Power Saver' or 'Not connected' message on the screen during an operation.	The video signal is not recognized by the display. Check that the signal cable's connector is inserted properly. Turn off the monitor and restart. If the message remains, try to locate the fault by replacing parts. NOTE: The described messages may appear at a start-up before the monitoring starts! This is normal and does not require further actions.

4.2 LCD Displays, D-LCC10, D-LCC12A, D-LCC15, D-LCC17 and D-LCC19

Problem	**Cause**	**Treatment**
No image on screen and no backlight	No power or loose interface cable.	Check LCD - ON/STBY switch position and interface cable.
No image on screen, backlight on	Cables may be loose. Display controller board or LCD Interface board failure.	Check the items. Replace the board(s) if necessary.
Vertical stripes on right side of screen continuously	Jumpers in Display controller board not positioned correctly.	Check the jumpers. See Installation section in Part I for details.

Only small portion of CRT screen is displayed on LCD display in zoomed-up form	LCD Display defined as High Resolution Display.	Change the resolution setting through the installation menus (in monitor software).
Unstable image	+5 V unstable. Loose cable. Jumpers in Display controller board not positioned correctly or board failure. LCD Interface board failure.	Check cable connections. Check the jumpers. Check the board(s) and replace if necessary.
Backlight flickering or dim	Backlight connector failure or lamp/LCD Interface board failure.	Check the connector. Check the lamp/ LCD Interface board failure. If faulty lamp, replace the backlight, if possible. See chapter 3.3. Disassembly and reassembly.

4.2.1 D-LCC15, D-LCC17 and D-LCC19

Please refer also to the display's Operators Manual.

Problem	**Cause**	**Treatment**
Picture is unclear. The picture looks much larger than the display screen.	Video signal resolution set to VGA or HIRES	D-LCC15: Change the resolution to XGA. D-LCC17, D-LCC19: Change the resolution to XGA (B-DISP19) or to SXGA (B-DISPX). Go to monitor setup -> Install/ Service→Installation → Display Setup menu select the resolution. The change is effective after start-up. NOTE: The resolution must be set after every Factory Reset.
Picture is unclear		Select 'HELP' from the Monitor keyboard then activate 'AUTO ADJUST' from the display's OSD menu. Continue with fine-tuning 'H-POSITION' or 'V-POSITION'. Adjust the horizontal position so that the left borderline of the leftmost digit field is just visible. Adjust the vertical position so that the digit field's bottom borderline is just visible.
Picture is unclear. Part of the text flickers.		Continue the fine-tuning with the 'PHASE or first 'CLOCK' and then 'PHASE' adjustment.

4.2.2 D-LCC17 and D-LCC19

Please refer also to the display's Operators Manual.

Problem	**Cause**	**Treatment**
Picture is unclear. Colors are not perfect.	Display controller board is not compatible with D-LCC17 or D-LCC19.	Check that the display controller board is compatible with the display. Displays require B-DISP19 or B-DISPX.

4.2.3 Plasma Display, D-MMP42 and D-MMP43

For troubleshooting information, refer to the literature included with the display.

D-MMP42 and D-MMP43 require XGA resolution.

4.3 Display Controller Boards, B-DISP, B-DISP19 and B-DISPX

Problem	**Cause**	**Treatment**
No image on the screen	No power Cable or display board loose Board or display faulty	Check power on Check cable and board connections Try with another board and/or display
Regular stripes on the picture	Faulty Display controller board Display not fully compatible with display controller board	Replace the board. Try an other type of display or display controller board
Part of the screen has wrong colors	Triac board failure	Replace triac board, see Part II/8-Module Frame, F-CU8/Power supply.
Picture disfigured	Outer magnetic field	Turn the monitor off, wait 10 minutes and turn the monitor on again in order to demagnetize the screen.
The picture is unclear The picture looks much larger than the display screen	The set resolution is not compatible with the display in use.	Change the resolution setting through the installation menus (in monitor software).

5 Earlier revisions

This manual fully supports the earlier revisions, except for the following displays. In their case, please refer to the following manuals for more service information:

LCD-Display D-LCC10 revision 01	Service Manual p/n 882580
LCD-Display D-LCC10 revision 02	Service Manual p/n 885930
LCD-Display D-LCC10 revision 03...04	Technical Reference Manual 8005672 and 8005796: Displays and Display Contollers slot 8005675

APPENDIX A Service check form, Video Display, D-VMC15

Customer		
Service	Display type and revision	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Cover and the picture tube	☐	☐	☐	2. Power cord locking	☐	☐	☐
3. Power cord	☐	☐	☐	4. Video cable	☐	☐	☐
Notes							
5. Power ON LED	☐	☐	☐	6. Contrast and brightness adjustments	☐	☐	☐
7. Position adjustments	☐	☐	☐	8. Color temperature adjustments	☐	☐	☐
9. Light sensor	☐	☐	☐				
Notes							

10. Electrical safety test	☐	☐	☐	11. Functioning after safety test	☐	☐	☐
12. Final cleaning	☐	☐	☐				

Notes

Used spare parts			

Signature

APPENDIX B Service check form, Video Display, D-VNC15

Customer		
Service	Display type and revision	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
1. Cover and the picture tube	☐	☐	☐	2. Power cord locking	☐	☐	☐
3. Power cord	☐	☐	☐	4. Video cable	☐	☐	☐
Notes							
5. Power ON LED	☐	☐	☐	6. Position adjustments	☐	☐	☐
7. Size adjustments	☐	☐	☐	8. Shape adjustments	☐	☐	☐
9. Tilt adjustment	☐	☐	☐	10. Degaussing	☐	☐	☐
11. Color temperature adjustments	☐	☐	☐	12. Contrast mode selection	☐	☐	☐
Notes							

13. Electrical safety test	☐	☐	☐	14. Functioning after safety test	☐	☐	☐
15. Final cleaning	☐	☐	☐				

Notes

Used spare parts			

Signature

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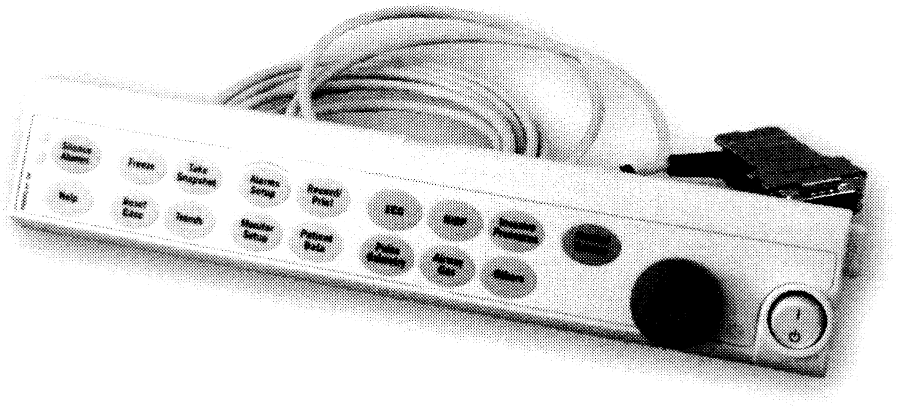
S/5™ Command Bar, K-ANEB/K-ICUB

Command Board, K-ANE/K-ICU

Technical Reference Manual



All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

M1027814
May, 2005

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Appendix A: Service check form, Command Board, K-ANE/K-ICU, Command Bar, K-ANEB/K-ICUB **A-1**

Introduction

This section provides information about the maintenance and service of the following products:

- Command Boards, K-ANE/ K-ICU
- Command Bars, K-ANEB/ K-ICUB

The service menu is described in a separate “Service Menu“ slot and the spare part lists in the “AM, CCM Spare Parts” slot.

1 Specifications

1.1 Command Board, K-ANE/K-ICU

Dimensions, W × D × H	315 × 55 × 43 mm
Weight (incl. cable)	0.5 kg
Input voltage	5 V
Power consumption	450 mW max
Communication protocol	RS-232

NOTE: Power supply from the display controller board only.

1.2 Command Bar, K-ANEB/K-ICUB

Dimensions, W × D × H	282 × 26 × 54 mm
Weight (incl. cable)	0.4 kg
Input voltage	5 V
Power consumption	350 mW max
Communication protocol	RS-232

NOTE: Power supply from the display controller board only.

2 Functional description

2.1 Command Boards, K-ANE/K-ICU and Command Bars, K-ANEB/K-ICUB

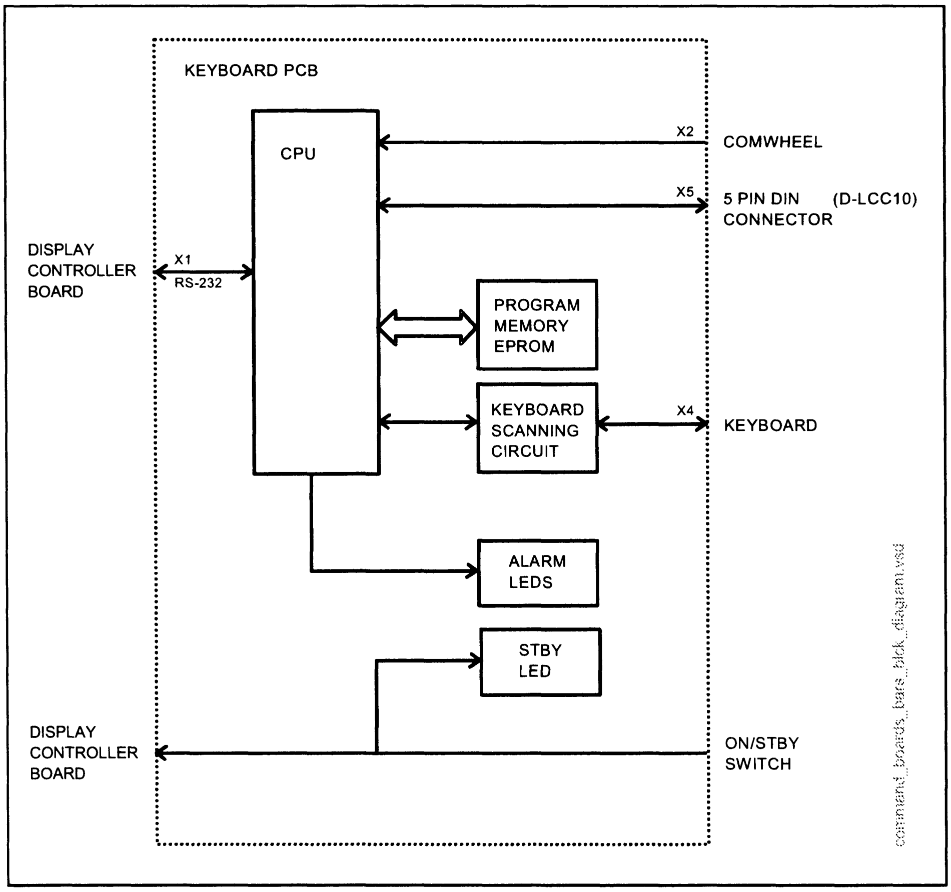

KEYBOARD PCB
CPU
X2
COMWHEEL
X5
5 PIN DIN (D-LCC10)
CONNECTOR
DISPLAY
CONTROLLER
BOARD
X1
RS-232
PROGRAM
MEMORY
EPROM
KEYBOARD
SCANNING
CIRCUIT
X4
KEYBOARD
ALARM
LEDS
STBY
LED
DISPLAY
CONTROLLER
BOARD
ON/STBY
SWITCH
command_boards_bars_blck_diagram.vsd

Figure 1 **K-ANE/K-ICU and K-ANEB/K-ICUB block diagram**

2.1.1 K-ANE/K-ICU, K-ANEB/K-ICUB

The Command Board/Bar consists of 17 direct function keys, ComWheel and ON/STBY switch.

2.1.2 Command Board/Bar PCB

The PCB is located inside the Command Board/Bar. The board reads the status of the front panel keys and the ComWheel and forwards the information to the CPU board.

2.1.3 External communication

Communication with the host processor takes place in RS232 serial communication channels which are available in both the CPU bus and the module bus. Two signals, TXD and RXD, are in use. No handshaking is used. The 26-pin subminiature D-connector of the Command Board/Bar is connected to a Display controller board. Serial communication speed rate is 19.2 kbps.

2.1.4 ComWheel

The ComWheel on the front panel is used for menu selection.

2.1.5 LEDs

The alarm LEDs are activated by the Command Board/Bar PCB under the commands received via serial communication from the CPU board. The red or yellow alarm LED is lit, when the red or yellow alarm is activated. The STBY led is lit, when the device is turned to stand-by and connected to the mains.

NOTE: If there are two Command Boards/Bars connected to the system, the system is ON (STBY LED not lit), when at least one of the switches is positioned ON.

2.1.6 Connectors and signals

Table 1 26-pin D-connector on K-ANE/K-ICU and K-ANEB/K-ICUB

Pin No	I7O	Signal
1		GND
2	I	Not connected
3		Not connected
4		Not connected
5		Not connected
6		Not connected
7		Not connected
8		Not connected
9		Not connected
10		+5 V
11	I	ON/STBY
12	O	Not connected
13		Not connected
14		TXDD RS232
15	O	RXDD RS232
16	I	Not connected
17		Not connected
18		Not connected
19		Not connected
20		Not connected
21		Not connected
22		Not connected
23		Not connected
24		Not connected
25		Not connected
26		Not connected

3 Service procedures

3.1 General service information

Field service is limited to replacing faulty PC boards or mechanical parts. The PC boards are then returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation and a detailed description of the fault.

CAUTION Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.2 Service check

These instructions include complete procedures for a service check. The service should be performed after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A") which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check form should be signed after performing the procedure.

3.2.1 Recommended tools

Tool	Order No.	Notes
Central Unit		
Screwdriver		

Command Board, K-ANE/K-ICU and Command Bar, K-ANEB/K-ICUB

3.2.2 Visual inspection

- Turn the monitor to STBY.

1. Cable

   Disconnect the command board cable from the display controller board.
   Check that the connector pins of the cable are clean, straight and at about the same height.
   Check that the cable is intact. Check that the locking screws inside the connector case are intact.

   Leave the cable disconnected.

   ✍

2. Front cover and front panel sticker

   Check that the plastic front cover and the front panel sticker are intact.

3. ComWheel cover

   Check that the ComWheel cover is intact and attached properly.

4. ON/STBY switch and protector

   Check that the ON/STBY switch and its protector (in K-ANE/K-ICU) are intact and attached properly. Check that the ON/STBY switch changes its state firmly when turning it back and forth. Leave the switch into STBY position.

5. Stand-by LED

   Reconnect and lock the command board/bar cable to the display controller board.

   Check that the stand-by LED is lit up (the Central Unit power cord is connected to the mains).

3.2.3 Functional inspection

- Turn the monitor on and enter the service menu:

  Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

6. Command board software

   Take down the information regarding keyboard software.

7. Alarm LEDs

   Select the menu ***KEYBOARD*** with the ComWheel.

   Highlight the text ***UPPER LED***. Check that the red alarm LED is turning on and off when pressing the ComWheel. Check also the yellow alarm LED by selecting ***LOWER LED*** from the menu.

8. Membrane keys

   Press the keys one by one. Check that each key generates a sound from the loudspeaker and the corresponding text in the menu changes from yellow to red.

9. ComWheel

   Turn the ComWheel clockwise and counterclockwise and check that each step generates a sound and the corresponding values at the bottom of the menu increase.

Select ***DUMMY PRESS***. Press the ComWheel and check that the press generates a sound and the corresponding value in the menu increases.

10. Electrical safety check

    Perform an electrical safety check and a leakage current test.

11. Functioning after electrical safety check

    Check that the Command Board/Bar functions normally after the performed electrical safety check.

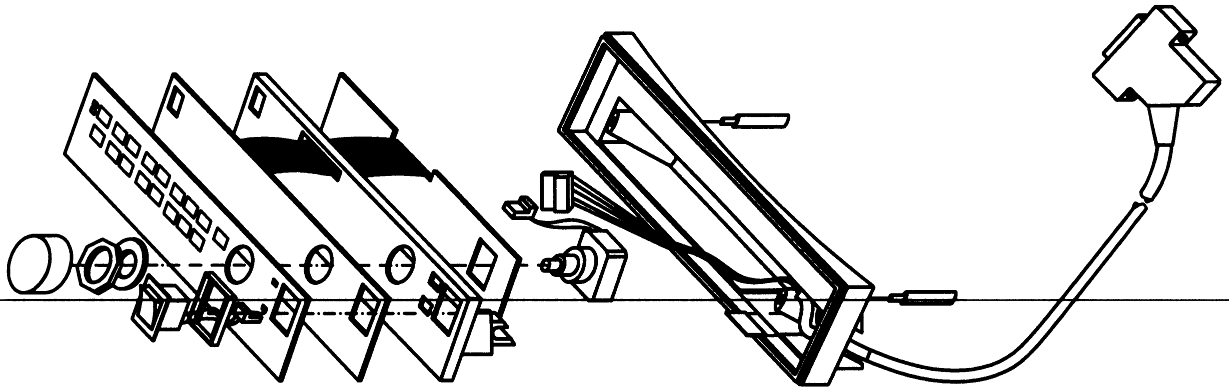
12. Final cleaning

    Clean the Command Board/Bar.

- Fill in all necessary documents.

3.3 Disassembly and reassembly

3.3.1 Command Board, K-ANE/K-ICU



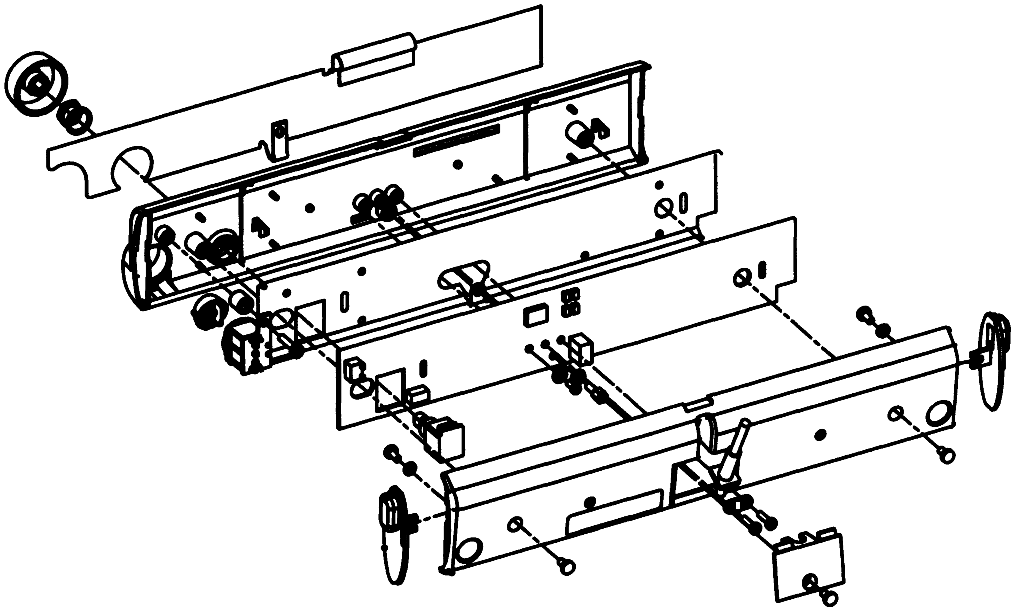
The Command Board is disassembled according to the following procedure. Please refer to the exploded view of the Command Board.

1. Disconnect the display power cable, the display data cable and the Command Board cable from the Central Unit.
2. Turn the display on its side and loosen the two cross head screws holding the Command Board to the display screen tray.
3. Lift off the Command Board and pull out the Command Board cable through the slot in the display screen tray.
4. Unscrew the two plastic screws holding the front cover of the Command Board to the rear cover. Carefully remove the rear cover.

5. Disconnect the Command Board cable, the wire set from the ON/STBY switch, the wire set from the ComWheel and the flat cable from the membrane keyboard.
6. Detach the Command Board PCB by pressing the two plastic fasteners holding the PCB in place and simultaneously lifting off the PCB.

The Command Board is reassembled by reversing the disassembly procedure.

3.3.2 Command Board, K-ANEB/ K-ICUB



The Command Bar is disassembled according to the following procedure. Please refer to the exploded view of the Command Bar.

1. Disconnect the Command Bar cable from the Central Unit.
2. Remove the Command Bar from the display unit.
3. Unscrew the three screws holding the front cover of the Command Bar to the rear cover. Carefully remove the rear cover.
4. Disconnect the Command Bar cable, the wire set from the ON/STBY switch, the wire set from the ComWheel (K-ANEB, K-ICUB) and the flat cable from the membrane keyboard (K-ANEB, K-ICUB).
5. Detach the Command Bar PCB by pressing the two plastic fasteners holding the PCB in place and simultaneously lifting off the PCB.
6. The Command Bar is reassembled by reversing the disassembly procedure.

4 Troubleshooting

4.1 K-ANE/ K-ICU/ K-ANEB/ K-ICUB

See Keyboard Service Menu in Service Menu Slot "Section 1", and perform the tests available. If any of the tests fail, see explanation below.

Problem	**Cause**	**What to do**
ON/STBY switch not working	Keyboard cable loose or broken. D-26 connector pin failure. Switch leads broken. Switch connector loose. Switch faulty.	Check the items. Replace them if necessary
ComWheel not working	ComWheel leads broken or connector loose. ComWheel faulty.	Check the items. Replace the ComWheel if necessary
Membrane key not working	Switch cable loose or broken. Keyboard cable loose or broken. D-26 connector pin failure. RS232 communication failure on CPU board	Check the items. Replace them if necessary.

5 Earlier revisions

For more service information on the earlier revisions, please refer to:

Command Board revision 01	Service Manual p/n 880850
Command Board revision 02	Service Manual p/n 885930

This manual supports all later revisions.

APPENDIX A Service check form, Command Board, K-ANE/K-ICU, Command Bar, K-ANEB/K-ICUB

Customer		
Service	Keyboard type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Cable	☐	☐	☐	2. Front cover and front panel sticker	☐	☐	☐
3. ComWheel cover	☐	☐	☐	4. ON/STBY switch and protector	☐	☐	☐
Notes							
5. Stand-by LED	☐	☐	☐				
6. Command board software	KB						
7. Alarm LEDs	☐	☐	☐	8. Membrane keys	☐	☐	☐
9. ComWheel	☐	☐	☐				
Notes							

10. Electrical safety check	☐	☐	☐	11. Functioning after electrical safety check	☐	☐	☐
12. Final cleaning	☐	☐	☐				

Notes

Used spare parts			

Signature

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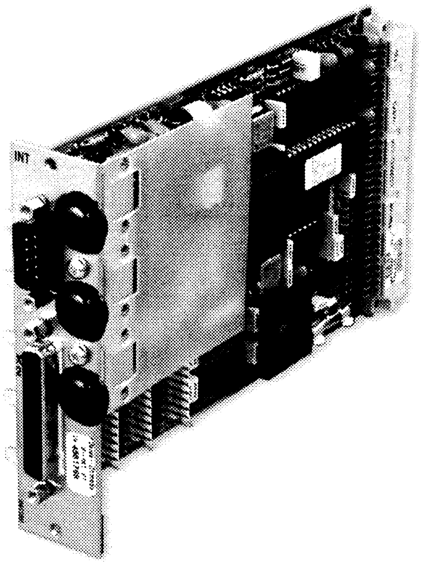
S/5™ Interface Board, B-INT (Rev.01)

Technical Reference Manual



All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

M1027815
May, 2005

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Appendix A: Service check form, S/5 Interface Board, B-INT A-1

Introduction

The Interface Board, B-INT, provides an interface between the S/5 Anesthesia Monitor or the S/5 Critical Care Monitor and other monitors. It also provides a connection between the Central Unit, F-CU8, and the Airway Module, G-xxxx.

The service menu is described in a separate "Service Menu" slot and the spare part lists in the "AM, CCM Spare Parts" slot.

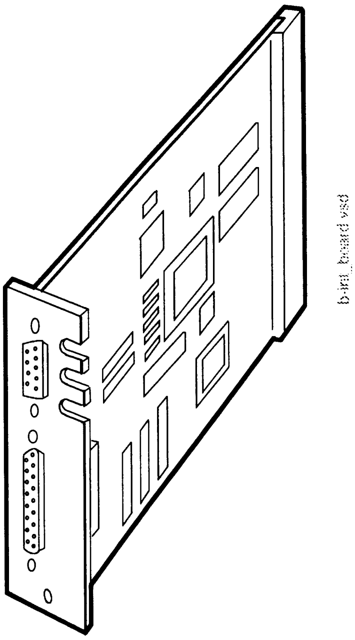


Figure 1 Interface Board, B-INT

NOTE: The Interface Board, B-INT, and Interface Module, M-INT / E-INT, cannot be used simultaneously in the same monitor.

1 Specifications

1.1 Serial I/O definitions

- RS-232 buffered (channels 1-4)
- All standard baud rates are possible from 300 to 115200
- Each interfaced device has fixed baud rate

1.2 Analog definitions

There are four analog inputs available on channel 1 and four on channel 2.

All analog inputs are op-amp buffered, with an input impedance of 1 M. Each analog input is also equipped with a 1 MΩ pull-down resistor to -12 V for NC detection.

Sampling rate: 10 ms/sample/channel

Input range: -10 V...+10 V

Resolution: 10 bits → 1024 voltage levels in input range

2 Functional description

The Interface Board, B-INT, detects and identifies external monitors connected to the S/5 Anesthesia or Critical Care Monitoring system. Identification is made by a serial data string sent by the external monitor.

On the front panel of the board there is a 25-pin and a 9-pin D-connector, which are used for sending/receiving digital serial data. The 25-pin D-connector is used for connecting the Airway Module (as the Gas Interface Board is removed when the Interface Board, B-INT, is installed).

On the surface of the circuit board there are three pin row connectors, one for digital data and two for digital and analog data. If digital and analog real time waveforms are required, the external monitor can be connected to the serial/analog connectors (X7 and X8) using additional interface connector cables.

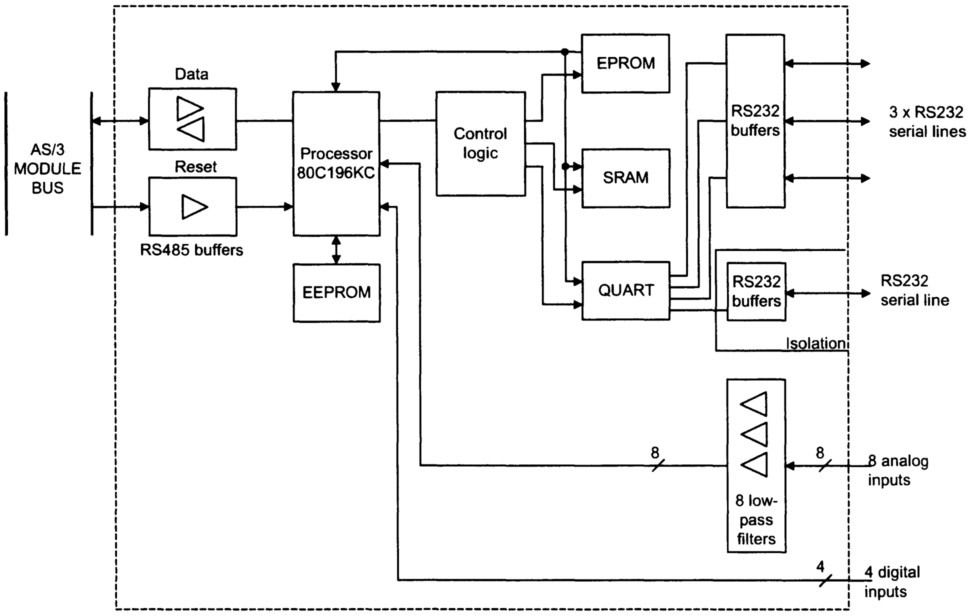

AS/3
MODULE
BUS
Data
Reset
RS485 buffers
Processor
80C196KC
EEPROM
Control
logic
EPROM
SRAM
QUART
RS232
buffers
3 x RS232
serial lines
RS232
buffers
RS232
serial line
Isolation
8
8
8 analog
inputs
8 low-
pass
filters
4
4 digital
inputs

Figure 2 Interface Board, B-INT, block diagram

2.1 Main components

The Interface Board contains an 80C196KC16 CPU.

External connections

The connectors on the board are:

- 96-pin E-connector for the CPU mother board (X1)
- 25-pin D-connector for an Airway Module (X3).
- 9-pin D-connector for RS-232 level isolated serial communications (X2). No analog inputs available.

In addition, three pin-row connectors on the circuit board make the following connections possible using an interface connector cable:

- RS-232 level serial and analog connectors for all interfaces (X7, X8).

- RS-232 level serial digital connector (X9).

X3 and X9 connectors can be used to interface waveforms from Dräger Cato and Cicero external monitors.

The Interface Board is connected to the Central Unit module bus through the CPU mother board.

Serial communication signals for transmitting (TxD) and receiving (RxD) data are sent to the micro controller ports. The direction of the communication is controlled by REC/SND/ signal at the buffers. The RESET/ signal always resets the communication to the RxD state.

Reset

The Interface Board is reset when the Central Unit is reset (MAIN/RESET/) or when the module bus is reset (RESET_RS485).

The RESET/ signal is sent to an address decoding GAL circuit, from which it goes to the micro controller as RESET/Z. When the RESET/ is active (low), the RESET/Z also goes low and resets the microcontroller.

Serial communication channels

A QUART is used to provide four serial communication channels (TxD, RxD). The micro controller is able to reset the QUART at any time by pulling the QRESET signal high. The QUART is also reset when the micro controller is reset; the micro controller pulls all the port 1 signals high when it resets.

Memory

There is a static RAM, EPROM and EEPROM memory and an address decoding GAL unit on the Interface Board.

The micro controller communicates with the EEPROM in serial mode.

Digital inputs

Four digital inputs are connected to connector X9 on the Interface Board. They pass through to the micro controller's high speed pins (DIGBUS). The digital inputs have an overvoltage protection and a pull-up circuit.

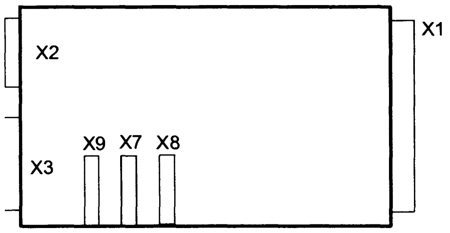
Analog inputs

Eight analog inputs are connected to connectors X7 and X8. They pass through EMI filters and low-pass filters to the microprocessor port 0.

Fuse

A 4 A fuse is installed on the Interface Board for the +24/+32 Vdirty input supply. This voltage is not used on the board, but passed through to the 25-pin D-connector for Airway Module use.

2.2 Connectors and signals



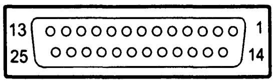
2.2.1 Bus connectors

Table 1 Module bus connector (X1)

Pin No.	a	b	c
1	+15 V	AGND	DGND
2	-15 V	BALE	DGND
3	SA0	SA1	DGND
4	SA2	SA3	RESET_RS485
5	SA4	SA5	-RESET_RS485
6	SA6	SA7	DATA_RS485
7	SA8	SA9	-DATA_RS485
8	SA10	SA11	TXDD_RS232
9	SA12	SA13	RXDD_RS232
10	SA14	SA15	BIT0IN
11	SA16	SA17	BIT1IN
12	SA18	SA19	TXDC
13	SA20	SA21	RXDC
14	SA22	SA23	RTSC
15	-SMEMR	-SMEMW	CTSC
16	-IOR	-IOW	TXDB
17	CLK	-RESET	RXDB
18	-IOCHRDY	IRQ10	RTSB
19	N/C_1	IRQ11	CTSB
20	N/C_2	IRQ12	TXDA
21	-SBHE	IRQ15	RXDA
22	SD0	SD1	RTSA
23	SD2	SD3	CTSA
24	SD4	SD5	LOUDSPEAKER
25	SD6	SD7	+5 V
26	SD8	SD9	+5 V
27	SD10	SD11	+5 V

Pin No.	a	b	c
28	SD12	SD13	+5 V
29	SD14	SD15	ON/STBY
30	+15 VD	-RESET_CPU	+5 V_CPU
31	+15 VD	+32 VD	REFRESH_WD
32	GNDD	GNDD	POWER_FAIL

Table 2 Airway Module bus connector (X3)

	Pin No.	I/O	Signal
	1	O	RESET_RS485
	2	O	-15 VDC
	3	O	+15 VDIRTY
	4	O	+15 VDC
	5	I/O	-DATA_RS485
	6	I/O	DATA_RS485
	7		Ground & Shield
	8	O	-RESET_RS485
	9	O	CTSB
	10	I	RTSB
	11	O	RXDB
	12	I	TXDB
	13		Ground & Shield
	14	O	+32 VDIRTY
	15	O	GroundDIRTY
	16	O	CTSC
	17	I	RTSC
	18	O	RXDC
	19	I	TXDC
	20		ON/STANDBY
	21		BIT0IN
	22		RXDD_RS232
	23		TXDD_RS232
	24	O	+5 VDC
	25	O	+5 VDC

2.2.2 Serial connectors

Table 3 Serial connector (X2)

Pin No.	I/O	Signal
1		N/C
2	I	RXD RS
3	0	TXD RS
4	0	+5 V
5	0	GND
6		N/C
7	0	RTS RS
8	I	CTS RS
9		N/C

Table 4 Serial Connector (X9) CH 4 (non-floating, off-board)

Pin No.	Definition
1	D0 digital input
2	RXD
3	TXD
4	D1 digital input
5	GND
6	D2 digital input
7	RTS
8	CTS
9	D3 digital input

2.2.3 Serial/analog connectors

Table 5 Serial/analog connector (X8) CH 1 (non-floating, off-board)

Pin No.	Definition
1	A0 analog input
2	RXD
3	TXD
4	A1 analog input
5	GND
6	A2 analog input
7	RTS
8	CTS
9	A3 analog input

Table 6 Serial/analog connector (X7) CH 2 (non-floating, off-board)

Pin No.	Definition
1	A4 analog input
2	RXD
3	TXD
4	A5 analog input
5	GND
6	A6 analog input
7	RTS
8	CTS
9	A7 analog input

Table 7 Power test connector (X4)

Pin No.	Signal
1	+5 Vref
2	+5 V
3	+12 V
4	DGND
5	-12 V
6	NC

Analog test connector

This connector is for factory tests only.

3 Service procedures

3.1 General service information

A faulty Interface Board, B-INT, should be returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation, and a detailed description of the fault.

CAUTION Only trained personnel with appropriate equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.2 Service check

These instructions include complete procedures for a service check. The service should be performed after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A") which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check form should be signed after performing the procedure.

3.2.1 Recommended tools

Tool	**Order No.**	**Notes**
Central Unit		
Airway Module		
GE Healthcare gas monitor with the SpO_2 measurement		e.g. ULT-S
INT Interface cable	892377	
Interface connector cable	882353	
Calibration gas		
SpO_2 probe		
Screwdriver		

3.2.2 Visual inspection

- Make sure the S/5 monitor is turned to STBY.
- Press the Service Reset switch at the back of the monitor power supply unit for at least five seconds.
- Disconnect all external interface cables connected to the Interface Board, B-INT. Remove the screws securing the Interface Board, B-INT to the Central Unit and remove the Interface Board.

1. Rear panel connectors

   Check that the rear panel connectors are clean and intact. Check that the block screws for cables are in place, tightened properly and that their threads are intact.

   ✍

2. Interface connector cables

   Check all interface connector cables (order code 882353) connected to the Interface Board:

   - the cables are intact and properly attached with screws
   - the cable connectors are clean and intact
   - the block screws for cables are in place and tightened properly
   - the block screw threads are intact

   ✍

3. Cable order

   Check the order of the interface connector cables, if connected:

   - top: connector X8
   - middle: connector X7
   - bottom: connector X9

   ✍

4. Grounding plate

   Check that the grounding plate under the rear panel is properly attached and not bent.

   NOTE: Older circuit boards may not include the grounding plate.

   ✍

5. Metal bracket attachment

   Check that the screws fastening the interface connector cable metal bracket to the Interface Board rear panel are tightened properly.

   ✍

6. IC attachment

   Check that all socket mounted IC's are inserted properly.

   ✍

7. Fuse

   Check that the fuse and fuse holder are clean and intact. Check that the fuse is of the correct rating (T4A).

   ✍

- Connect the interface connector cable to connector X8 on the Interface Board, if not yet connected. Re-install the Interface Board in the Central Unit and secure the board with two screws.

- Connect the Airway Module using a gas interface cable to the Interface Board rear panel connector X2. Connect the Datex-Ohmeda gas monitor using the interface cable, order code 892377 (use the gender changer) to Interface Board connector X8 (via the connected interface connector cable).

3.2.3 Functional inspection

- Turn both monitors on.
- Make sure the serial output mode of the Datex-Ohmeda gas monitor being used is set to NUMERIC.
- Configure the S/5 monitor screen so that all the required parameters are shown, for example:

  Monitor Setup - ***Screen 1 Setup*** - ***Waveform Fields*** - ***Field 5*** - ***Pleth***
  Field 6 - ***CO2***

8. Interface selection

   Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Installation*** - ***Interfacing*** - ***Gases/Spiro*** - ***Module***

   and

   Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Installation*** - ***Interfacing*** - ***Gases/Spiro*** - ***SpO2*** - ***Module***

   Check that menus NIBP and SvO_2/C.O. are selectable from the menu.

   ✍

9. Airway module interface (X2)

   Check that the waveform field for gases is shown on the S/5 monitor screen.

   When the message 'Calibrating gas sensor' disappears, feed calibration gas into the Airway Module sampling line and check that the CO_2 waveform and the gas numerics are shown correctly.

   ✍

   Set the Interface Board for the Datex-Ohmeda gas monitor being used:

   Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Installation*** - ***Interfacing*** - ***Gases/Spiro*** - ***XXX***

   and

   Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Installation*** - ***Interfacing*** - ***Gases/Spiro*** - ***SpO2*** - ***XXX***

   XXX = the gas monitor in use

10. Module software

    Enter the service menu:

    Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Service*** (password 26-23-8)

Record the information regarding the Interface Board software by selecting ***SCROLL VERS*** and turning the ComWheel.

11. Communication and memories

    Enter the B-INT service menu:

    Parameters - More... - Interface

    Check that the Time-outs, Bad checksums and Bad c-s by mod values are not increasing faster than by 5 per second. Check that the B-INT memories have passed the internal memory test, i.e. RAM and ROM state OK.

12. Recognition of connection

    Check that the interfaced gas monitor is identified, i.e. the required waveform fields are shown on the screen and the gas monitor type is shown correctly on the service menu.

    Check that the communication state is “online”.

13. Gas interface (X8)

    Select ***GASES*** from the B-INT service menu.

    Check that id: states the correct monitor and interface type, Active states YES and Time-out NO.

    Check that the numeric values on the service menu are reasonable.

    Simulate breathing by feeding calibration gas into the Datex-Ohmeda gas monitor sampling line and check that the values on the service menu correspond with the values on the gas monitor screen.

    Check that the values in the S/5 monitor gas waveform field are correct and a proper C0$_2$ waveform is shown.

    Stop feeding calibration gas. Check that the message ‘Apnea’ appears in the S/5 monitor waveform field, and in the message field, if the selected interface type is ULT/al.

14. Sp02 interface (X8)

    Select Sp0$_2$ from the B-INT service menu.

    Check that id: states the correct monitor and interface type, Active states YES and Time-out NO.

    Check that ProbeOff shows 1 when no Sp0$_2$ probe is connected to the interfaced gas monitor. Connect the Sp0$_2$ probe and check that NoProbe shows 1.

    Attach the Sp0$_2$ probe to your finger and check that the values on the menu correspond with the values on the gas monitor screen.

    Check that the values in the S/5 monitor pleth waveform field are correct and a proper pleth waveform is shown.

Disconnect the SpO_2 probe. Check that the message 'Probe off' appears in S/5 monitor waveform field, and 'SpO_2 probe off' appears in the message field, if the interface type is ULT/al.

✍

15. Recognition of disconnection

    Turn the gas monitor off. Check that the messages 'Interfaced Gas monitor removed' and 'Interfaced SpO_2 monitor removed' appear on the S/5 monitor screen.

    ✍

16. Interfacing (X7)

    Turn the monitor off. Connect the gas monitor with the interface cable, to Interface Board, B-INT, connector X7 (via the interface connector cable). If necessary, remove the Interface Board, B-INT, for relocating the interface connector cable.

    Turn the monitors on and check that the necessary numerics and waveforms are still interfaced, together with the necessary alarms, if the interface type is ULT/al.

    ✍

17. Interfacing (X9)

    Turn the monitors off. Connect the gas monitor with the interface cable, to Interface Board, B-INT, connector X9 (via the interface connector cable).

    Turn the monitors on and check that only the necessary numerics are interfaced, together with the necessary alarms, if the interface type is ULT/al.

    ✍

18. Interfacing (X3)

    Turn the monitors off. Connect the gas monitor with the interface cable, to Interface Board, B-INT, connector X3.

    Turn the monitors on and check that only the necessary numerics are interfaced, together with the necessary alarms, if the interface type is ULT/al.

    ✍

19. Electrical safety

    Perform an electrical safety check and a leakage current test.

    ✍

20. Functioning after electrical safety check

    Check that the Interface Board, B-INT, functions normally after performing the electrical safety check.

    Set the Interface back for modules:

    Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Installation - Interfacing - Gases/Spiro - Module***

    and

Monitor Setup - ***Install/Service*** (password 16-4-34) - ***Installation*** - ***Interfacing*** - ***Gases/Spiro*** - ***SpO2*** - ***Module***

- Fill in all necessary documents.

4 Troubleshooting

Enter the Service menu (see chapter 5). Select ***Scroll Vers*** and scroll down the SW version/Unit id list. Make sure that the software code and level, control and serial numbers of the Interface Board, B-INT, are displayed under B-INT/M-INT.

If they are not displayed, the Interface Board, B-INT, is faulty.

4.1 Troubleshooting chart

Problem	**Cause**	**What to do**
B-INT not active in the ***Service*** menu.	B-INT is not connected properly. B-INT is faulty.	Check that B-INT is firmly pushed into the connector. Replace B-INT and send it for repair.
Measured values from the interfaced monitor do not appear on the display after approximately one minute.	Monitor not selected for interface. Poor contact in the interface cables. Wrong interface cable.	Select correct monitor from ***Install/Service - Interfacing*** menu. Check the cables and connections. Change the cable to another connector. Check cable type and if necessary change the cable.

5 Earlier revisions

This manual also supports Interface Board, B-INT (rev. 00).

APPENDIX A Service check form, S/5 Interface Board, B-INT

Customer		
Service	Board type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
1. Rear panel connectors	☐	☐	☐	2. Interface connector cables	☐	☐	☐
3. Cable order	☐	☐	☐	4. Grounding plate	☐	☐	☐
5. Metal bracket attachment	☐	☐	☐	6. IC attachment	☐	☐	☐
7. Fuse	☐	☐	☐				
Notes							
8. Interface selection	☐	☐	☐	9. Airway module interface (X2)	☐	☐	☐
10. Module software	B-INT						
11. Communication and memories	☐	☐	☐	12. Recognition of connection	☐	☐	☐
13. Gas interface (X8)	☐	☐	☐	14. SpO2 interface (X8)	☐	☐	☐
15. Recognition of disconnection	☐	☐	☐	16. Interfacing (X7)	☐	☐	☐
17. Interfacing (X9)	☐	☐	☐	18. Interfacing (X3)	☐	☐	☐
Notes							

19. Electrical safety	☐	☐	☐	20. Functioning after electrical safety check	☐	☐	☐

Notes

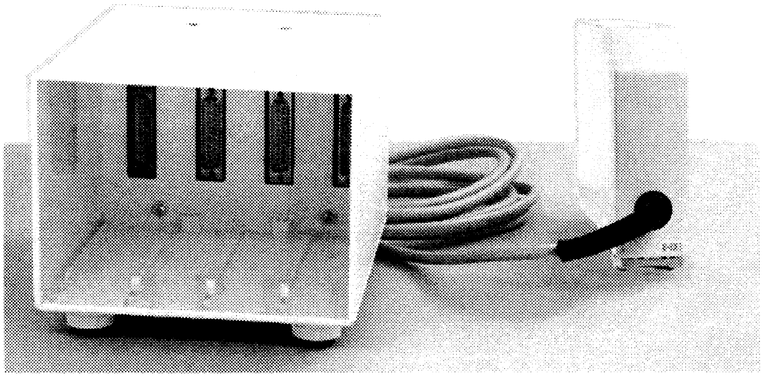
Used spare parts			

Signature

Datex-Ohmeda

S/5™ Extension Frame, F-EXT4, Extension Module, E-EXT

Technical Reference Manual



All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

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Appendix A: Service check form, Extension Frame, F-EXT4, Extension Module, E-EXT A-1

Introduction

The Extension Frame, F-EXT4 is designed for use with S/5 monitors and provides four additional module slots, and allows the measuring modules to be placed near the patient. The Extension Frame, F-EXT4 is connected to the monitor with the extension module, E-EXT. F-EXT takes up one module slot in the F-CU8 frame.

NOTES:

- Do not use F-EXT with F-CU5/F-CU5P.
- Only one F-EXT4 can be connected to the monitor at a time.
- The following modules cannot be used in the F-EXT4
  - Recorder Module, M-REC / E-REC
  - Memory Module, M-MEM / E-MEM
  - Interface Module, M-INT / E-INT
  - Compact Airway Modules, M-Cxxxxx / E-Cxxxxx
- Do not use identical modules simultaneously in the extension frame and in the host monitor.
- When the extension frame is used with the S/5 Anesthesia Monitor, the F-CU8 must be of rev. 03 or later.

The service menu is described in a separate "Service Menu" slot and the spare part lists in the "AM, CCM Spare Parts" slot.

1 Specifications

1.1 General specifications

Frame size (W × D × H)	160 × 205 × 137 mm
(w/ module)	160 × 228 × 137 mm
Frame weight	1.3 kg
Power consumption	35 W (max at input voltage of +32 V) with ESTP and NIBP modules inserted and NIBP pump working.
Module size (W × D × H)	37 × 180 × 112 mm/1.5 × 7.1 × 4.4 in

2 Functional description

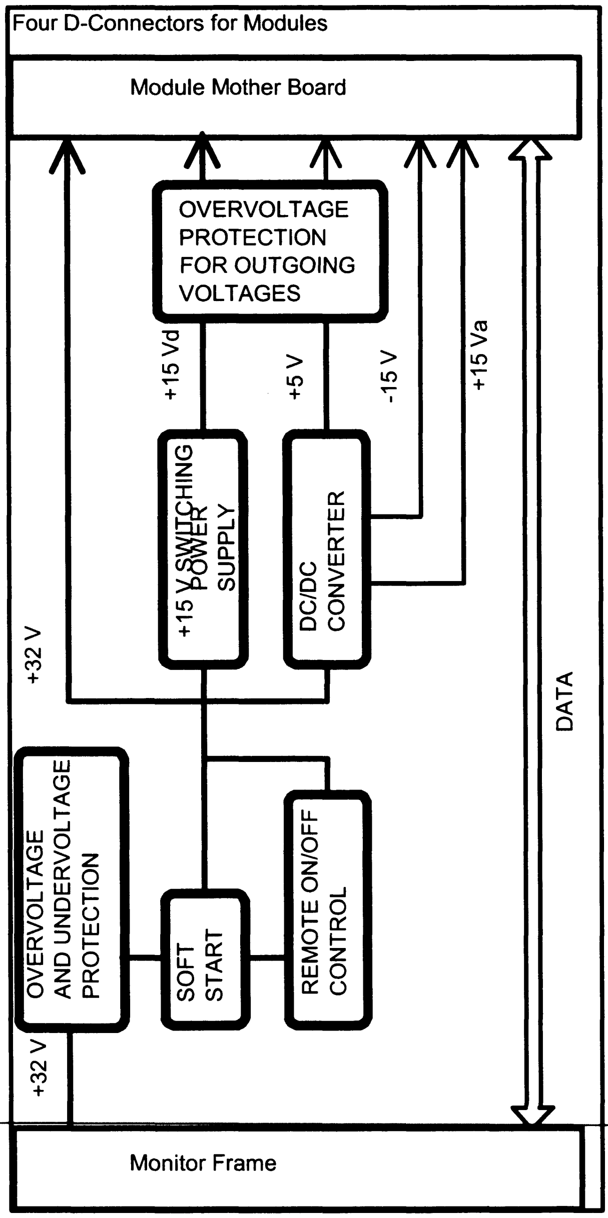

Four D-Connectors for Modules
Module Mother Board
OVERVOLTAGE PROTECTION FOR OUTGOING VOLTAGES
+15 Vd
+5 V
-15 V
+15 Va
+15 V SWITCHING POWER SUPPLY
DC/DC CONVERTER
+32 V
DATA
OVERVOLTAGE AND UNDERVOLTAGE PROTECTION
SOFT START
REMOTE ON/OFF CONTROL
+32 V
Monitor Frame

Figure 1 F-EXT electronics unit block diagram

The Extension Frame, F-EXT4, contains the module motherboard, power supply board, and space for four single-width or two double-width modules.

The electronic unit receives +32 V from the monitor frame and generates from it necessary operational voltages for the inserted modules. The received +32 V is passed through fuse (F1) and filtered and led to power supply components.

There is overvoltage and undervoltage protection for input voltage, the input voltage is set so that it can vary between +18.5 V and +36.0 V.

The purpose of the soft start is to raise the input voltage +32 V slowly (in about 1 second) to the maximum value so that capacitors in power supply components' circuits have time to get charged. This enables the extension frame to be connected to the monitor frame during operation.

There is also overvoltage protection for outgoing supply voltages. The overvoltage limits are +5.95 V (+5 V) and +17.50 V (+15 Vd).

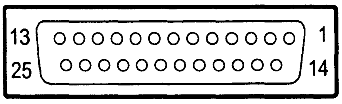
Signal routes

There are two connectors which are used for data communications (RS485), for supply voltages (+32 V, +15 Vd, +15 Va, and +5 V), for grounds connections (GNDD, GND&SHIELD) between the power supply board and module mother board.

2.1 Connectors and signals

2.1.1 Module bus connector

Table 1 Module bus connector (X1)

Module bus connector (X1)	Pin No.	I/O	Signal
	1	I	RESET_RS485*
	2	I	-15 VDC*
	3	I	+15 VDIRTY*
	4	I	+15 VDC*
	5	I/O	-DATA_RS485*
	6	I/O	DATA_RS485*
	7		Ground & Shield*
	8	I	-RESET_RS485*
	9	I	CTSB
	10	O	RTSB
	11	I	RXDB
	12	O	TXDB
	13		Ground & Shield*
	14	I	+32 VDIRTY*
	15	I	GroundDIRTY*
	16	I	CTSC
	17	O	RTSC
	18	I	RXDC
	19	O	TXDC
	20		ON/STANDBY*
	21		BITOIN*
	22		RXDD_RS232
	23		TXDD_RS232
	24	I	+5 VDC*
	25	I	+5 VDC*

* Used in the Extension Frame and in the Extension Module

2.1.2 Other connectors

Table 2 Extension Frame rear panel connector (X1)

Connector (X1)	Pin No.	I/O	Signal
	A	I	RESET_RS485
	B	I/O	-DATA_RS485
	C	I/O	DATA_RS485
	D	I	-RESET_RS485
	E	O	Direct ECG
	F	-	N/C
	G	I	+32 VDC
	H	I	Gnd and Shield (for data transmission)
	J	-	N/C
	K	-	N/C
	L	I	+32 VDC
	M	I	GndD (dirty) for power supply

3 Service procedures

The field service of the Extension Frame, F-EXT4, is limited to replacing faulty circuit boards or mechanical parts. The circuit boards should be returned to GE Healthcare for repair.

GE Healthcare is always available for service advice. Please provide the unit serial number, full type designation, and a detailed description of the fault.

CAUTION Only trained personnel with the appropriate tools and equipment should perform the tests and repairs outlined in this section. Unauthorized service may void warranty of the unit.

3.1 Service check

These instructions include complete procedures for a service check. The service should be performed after any service repair. Additionally, the service check procedures can also be used for determining possible failures.

The procedures should be performed in ascending order.

The instructions include a check form ("APPENDIX A") which should be filled in when performing the procedures.

The symbol ✍ in the instructions means that the check form should be signed after performing the procedure.

3.1.1 Recommended tools

Tool	**Order No.**	**Notes**
Hemodynamic module W/NIBP		
Adult NIBP cuff & hose		
Gas interface cable	884299	
Multimeter		
Screwdriver		

3.1.2 Visual inspection

- Disconnect the Extension Module, E-EXT / M-EXT from the host monitor, if connected.
- Disconnect the extension module cable from the Extension Frame, F-EXT4 rear panel.

Extension Module, E-EXT / M-EXT

- Detach the module box by removing the two screws from the back of the module. Be careful with the loose latch and spring pin for locking.

1. Internal parts

   Check that:

   – all screws are tightened properly

   - there are no loose objects inside the module

   ✍

2. External parts

   Check that:

   - the front cover and the front panel sticker are intact
   - the module bus connector is intact
   - the module box, the latch and the spring pin are intact
   - the extension module cable and its connector are intact
   - the screw on the cable connector is tightened properly

   ✍

- Reattach the module box and check that the latch is moving properly.

Extension Frame

3. Plastic frame

   Check that the plastic frame is intact.

   ✍

4. Mounting plate

   Check that the extension frame mount is tightened properly to the plastic frame.

   ✍

5. Fastening screws

   Check that the large fastening screw at the back of the mount is intact.

   ✍

6. Pads

   Check that all four rubber pads are in place on the bottom.

   ✍

7. Fan filter

   If the extension frame contains a fan (Rev. 02->), clean or replace the fan filter.

   ✍

8. Cable connector

   Check that the cable connector on the rear panel is clean and intact.

   ✍

9. Module motherboard connectors

   Check that the module motherboard connectors are clean and intact. Check also that the screws that connect the module motherboard to the frame are tightened properly.

10. Module motherboard position

    Check that the Hemodynamic module fits in smoothly and locks up properly in the slots in the extension frame.

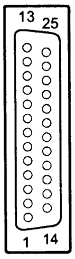
    Leave the module disconnected.

3.1.3 Functional inspection

11. Communication lines

    Measure resistance from the following module motherboard (F-EXT4) connector pins against the ground:

    Pin 1+Reset RS485
    Pin 5-Data RS485
    Pin 6+Data RS485
    Pin 8-Reset RS485
    Pin 13Ground



Module motherboard connector

Check that the resistance on each of the pins is higher than 10 kΩ. If not, replace the module motherboard.

12. E-EXT / M-EXT installation

    Connect and lock the extension module cable to the extension frame rear panel connector.

    Make sure that the monitor is switched to STBY, and then install the extension module into the monitor. Check that the module goes in smoothly and locks up properly.

13. Voltages

    Connect the gas interface cable (the grounding plates of the cable should be removed) to one of the module bus connectors of the extension frame.

Switch the monitor on and measure the module bus voltages from the loose gas interface cable connector (see the pin order from the previous figure). The output voltages should meet the following ranges:

Pin 2-15V -14.50...-15.50V
Pin 3+15VD14.50...15.50V
Pin 4+15V14.50...15.50V
Pin 14+32V31.0...33.0V
Pin 24+5V4.80...5.30V
Pin 25+5V4.80...5.30V

If any of the voltages is not within the given tolerance, replace the extension frame power supply board.

Disconnect the gas interface cable carefully.

✍

14. Fan

    If the extension frame contains a fan, check that the fan is running.

    ✍

15. Module communication

    Install the hemodynamic module with NIBP measurement into the extension frame. Make sure that similar modules are not installed into the monitor already. Check that the module is recognized, i.e. the needed parameter information is shown on the monitor screen.

    NOTE: If nothing happens, make sure the screen configuration is appropriate.

    Change the module position in the extension frame and check that the module is still recognized.

    ✍

16. Restarting 1

    Detach the extension module, E-EXT / M-EXT from the monitor, then install it again. Check that the module in the extension frame is still recognized.

    ✍

17. Restarting 2

    Disconnect the monitor's power cord shortly during the monitor is on. Check that the monitor recovers and the module in the extension frame is still recognized.

    NOTE: The monitor may give an audible alarm during the power loss.

    ✍

18. Test measurement with module

    Connect an adult NIBP cuff to the module and place the cuff onto your arm. Perform one NIBP measurement and check that the monitor gives a reasonable NIBP reading.

19. Electrical safety check

    Perform an electrical safety check and a leakage current test.

20. Functioning after electrical safety check

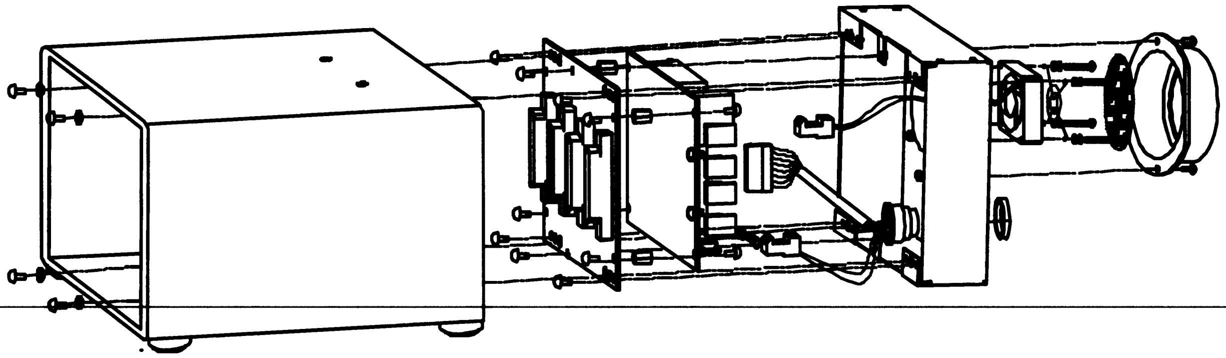
    Check that the extension frame functions normally after the performed electrical safety check.

21. Final cleaning

    Clean the extension frame and module with suitable detergent.

- Fill in all necessary documents.

3.2 Disassembly and reassembly



Disassemble the Extension Frame, F-EXT4 in the following way. See the exploded view of the frame.

1. Remove the four screws from the front of the frame. Detach the PC board's block.
2. Remove the four screws from module motherboard with which it is attached to the rear frame.
3. Carefully lift the module mother board and the power supply board attached to it and detach the two connectors under the power supply board.

3.2.1 Changing the fuse

Disassemble the F-EXT4 as described above. The fuse is located on the power supply board. Replace the fuse by the one with the same type and rating.

4 Troubleshooting

4.1 Troubleshooting chart

Problem	**Cause**	**What to do**
F-EXT4 does not work.	Connector not connected properly. Cable /Extension module is faulty.	Check connectors. Check cable/module.
F-EXT4 does not work.	Incoming voltage too high or too low.	Check the Central Unit output voltage. Replace the F-EXT4 power supply board, if necessary.
F-EXT4 does not work.	PC board(s) faulty.	Check the fuse on the power supply board. Check the PC boards and their connections. Replace the power supply board.
Fuse on power supply board is blown repeatedly.	Short-circuit in output voltages.	Replace the fuse. Remove modules and turn the power on. If works, some module is faulty. If not, check the PCBs. Replace the power supply board.

5 Earlier revisions

F-EXT4 Rev. 01, see also service manual p/n 889535.

M-EXT Rev. 00, see also service manual p/n 889535.

M-EXT Rev. 02, see also Technical Reference Manual Slot 8001007.

APPENDIX A Service check form, Extension Frame, F-EXT4, Extension Module, E-EXT

Customer		
Service	Module type	S/N
Service engineer		Date

OK = Test OK **N.A. = Test not applicable** **Fail = Test failed**

	OK	N.A.	Fail		OK	N.A.	Fail
1. Internal parts	☐	☐	☐	2. External parts	☐	☐	☐
Notes							
3. Plastic frame	☐	☐	☐	4. Mounting plate	☐	☐	☐
5. Fastening screws	☐	☐	☐	6. Pads	☐	☐	☐
7. Fan filter	☐	☐	☐	8. Cable connector	☐	☐	☐
9. Module motherboard connectors	☐	☐	☐	10. Module motherboard position	☐	☐	☐
Notes							

11. Communication lines		
+Reset RS485 (pin 1))		>10 kΩ
-Data RS485 (pin 5)		>10 kΩ
+Data RS485 (pin 6)		>10 kΩ
-Reset RS485 (pin 8)		>10 kΩ

	OK	N.A.	Fail	
12. E-EXT / M-EXT installation	☐	☐	☐	

13. Voltages		
-15 V (pin 2)		-14.50...15.50 V
+15 VD (pin 3)		14.50...-15.50 V
+15 V (pin 4)		14.50...15.50 V
+32 V (pin 14)		31.0...33.0 V
+5 V (pin 24)		4.80...5.30 V

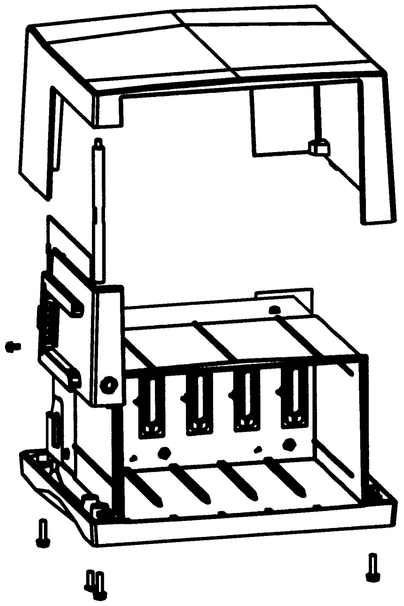
+5 V (pin 25)					4.80...5.30 V		
	OK	**N.A.**	**Fail**		**OK**	**N.A.**	**Fail**
14. Fan	☐	☐	☐	15. Module communication	☐	☐	☐
16. Restarting 1	☐	☐	☐	17. Restarting 2	☐	☐	☐
18. Test measurement with module	☐	☐	☐				
Notes							
19. Electrical safety check	☐	☐	☐	20. Functioning after electrical safety check	☐	☐	☐
21. Final cleaning	☐	☐	☐				

Notes

Used spare parts			

Signature

Datex-Ohmeda
S/5™ Anesthesia Monitor, S/5™ Critical Care Monitor
Spare Parts



All specifications are subject to change without notice.
CAUTION: U.S. Federal law restricts this device to sale by or on the order of a licensed medical practitioner.
Outside the USA, check local laws for any restriction that may apply.

M1039372
June, 2005

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1 PC boards and software licenses

1.1 Software licenses

Description	Order no.	Note
Service Software, anesthesia	S-ANE98S	
Service software, ARK	S-ARK98S	
Service Software Licence, anesthesia	L-ANE01(A)S	
Service Software Licence, anesthesia	L-ANE02(A)S	
Service Software License, anesthesia	L-ANE03..02(A)S	
Service Software License, anesthesia	L-ANE03..03(A)S	
Service Software Licence, anesthesia	L-ANE05(A)S	
Service Software, critical care	S-ICU98S	
Service Software Licence, critical care	L-ICU02(A)S	for B-CPU4
Service Software Licence, critical care	L-ICU05(A)S	for B-CPU5

1.2 CPU Board, B-CPU5/B-CPU4

Description	Order no.
CPU Board	B-CPU5
CPU Board	B-CPU4
Battery for SRAM/Timekeeper	197230
Lid for back plate	894934
Screw	617110

1.3 UPI4NET Board, B-UPI4NET, rev.00, 01, UPI4 Board, B-UPI4, rev.00

Description	Order no.
Block screw for cables	546096
UPI NET board	B-UPI4NET

1.4 Interface Board, B-INT

Description	Order no.
Fuse T4A	51134
Grounding plate	885404
Block screw for cables	546096
Interface connector cable	882353

1.5 Display Controller Boards, B-DISP, B-DISP19, B-DVGA, B-DHIGH

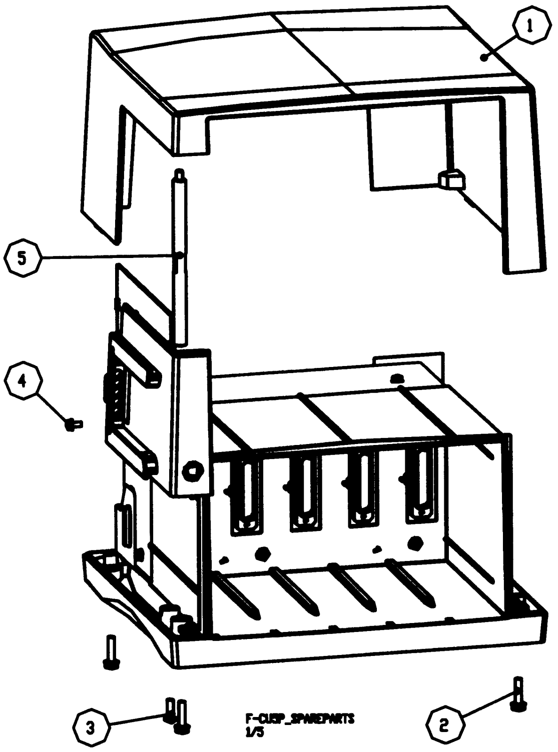
Description	Order no.
Wide rear panel for B-DISP	893872
Grounding plate	885398
Block screw for cables	546096

1.6 Display Controller Board, B-DISPX

Description	Order no.
Video cable, DVI-D (male) - DVI-D (male), 3m	M1005294
Video cable (adapter), DVI-I (male) - VGA (female), 0.6m	M1005320
Video cable (extension / adapter), DVI-I (male) - VGA (male), 10m	M1005324
Video cable, VGA (male) - VGA (male), 3m	8001593

2 5-Module Frame, F-CU5

2.1 5-Module Frame Unit, F-CU5(P)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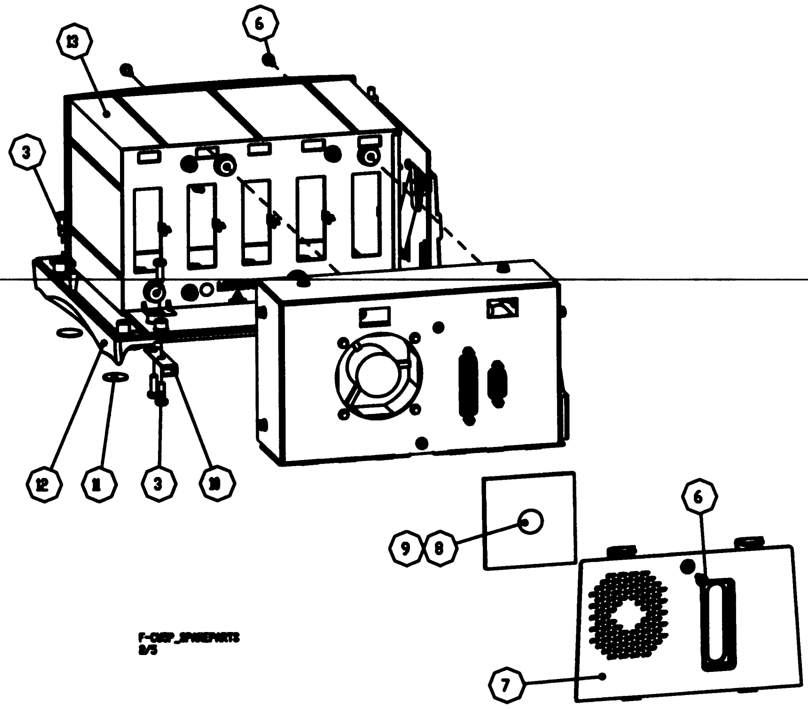
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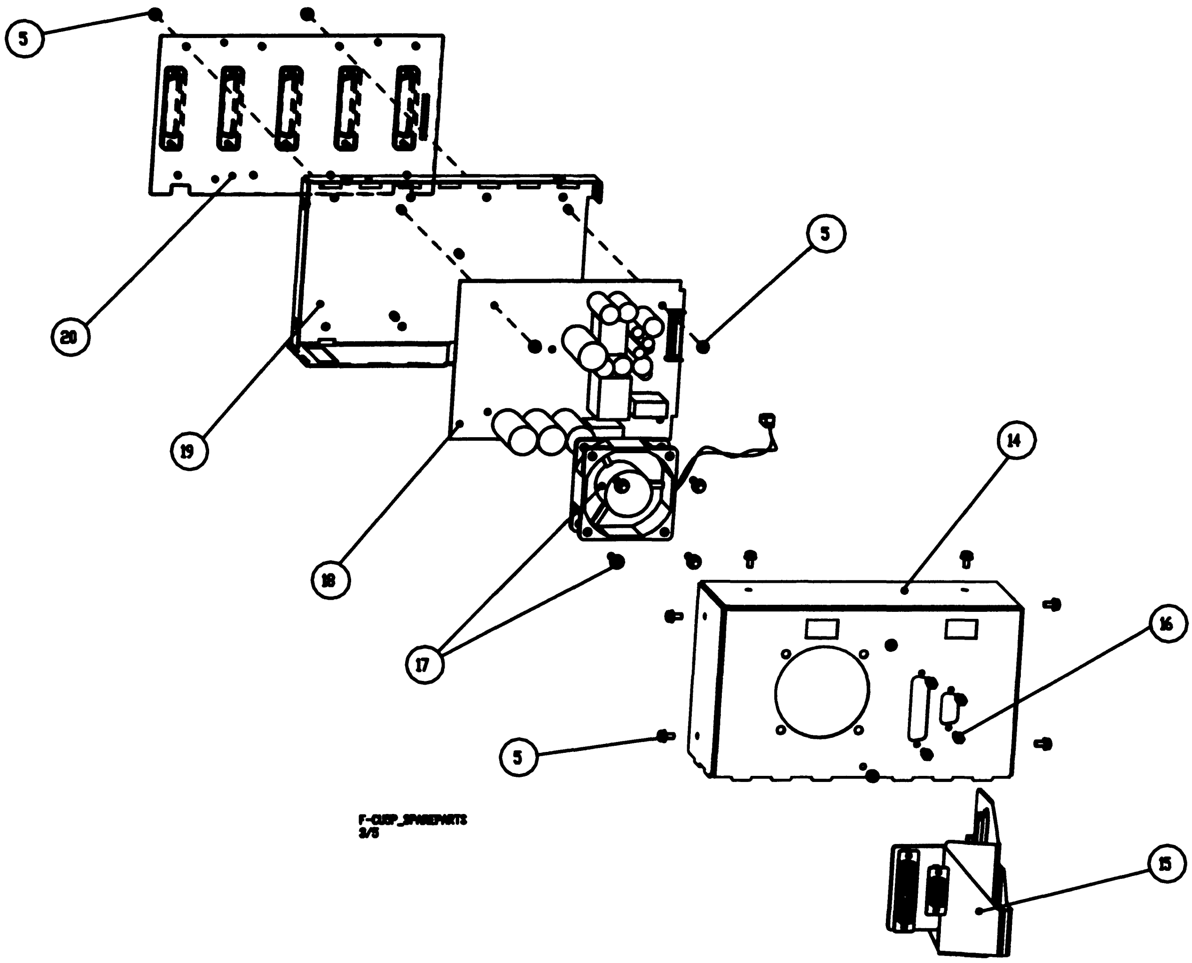
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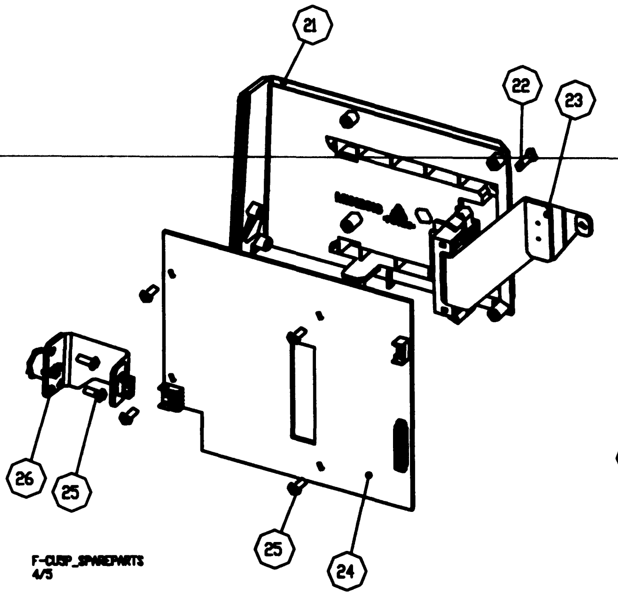
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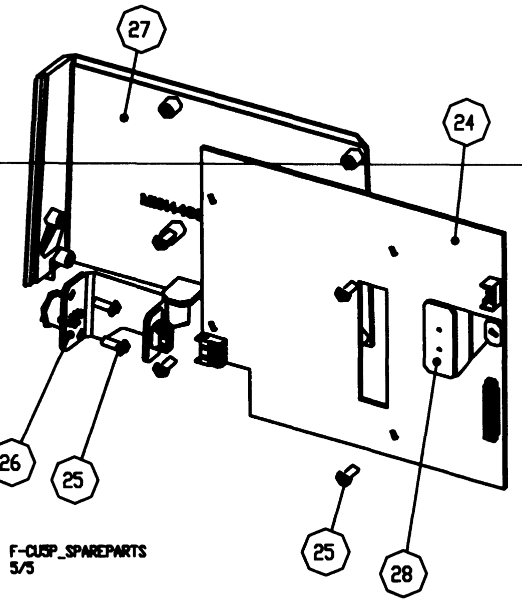
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F-CU5P_SPAREPARTS
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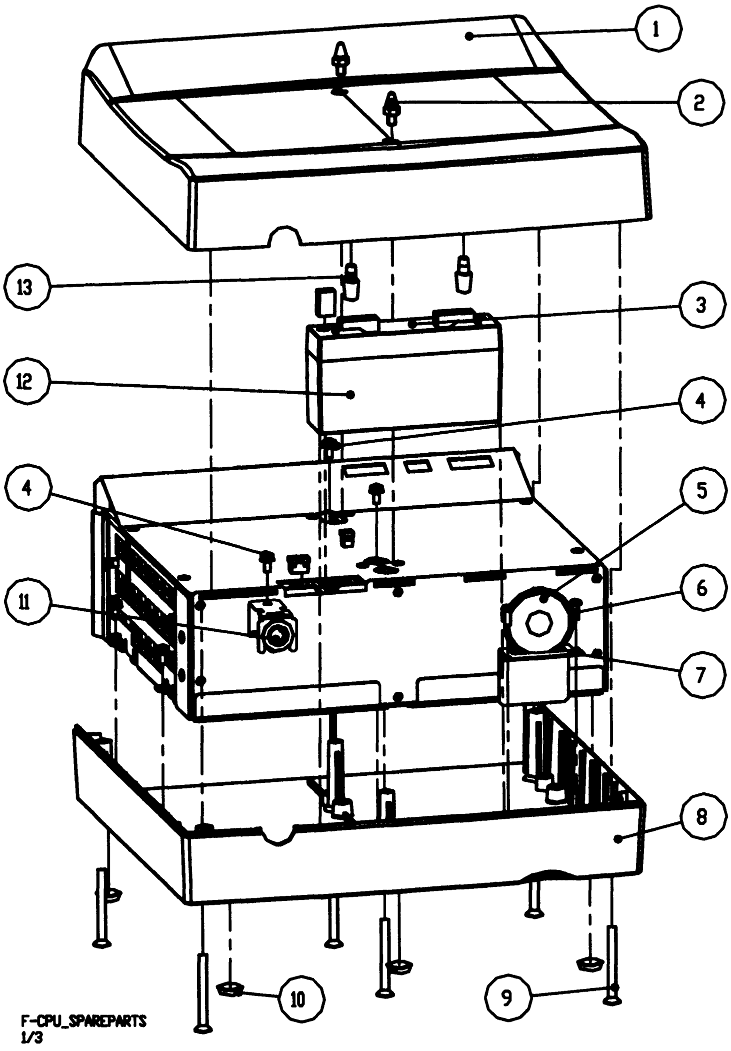
Item numbers refer to the exploded view.

Item	**Description**	**Order no.**
-	F-CPU Signal Cable, 0.3 m/12 inch	M1021337
-	F-CPU Signal Cable, 3.0 m/10 ft	M1021338
-	F-CPU Signal Cable, 10.0 m/ 33 ft	M1021339
-	F-CPU Power Cable, 0.4 m/16 inch	M1021340
-	F-CPU Power Cable, 2.7 m/9 ft	M1021341
1	NMF Module frame Top Cover	M1012000
2	SCREW, machine, M4x16mm, DIN6900-3, torx head, pan head, steel, zinc coated	M1024624
3	SCREW, thread forming, M4x12mm, WN1452, torx head, pan head, steel, zinc coated	M1024622
4	SCREW,machine, M3x6mm, DIN6900-3, torx head, pan head, steel, zinc coated	M1024616
5	Module frame Support Pole, F-CU5(P)	M1016908
6	SCREW, machine, M3x10mm, DIN6900-3, torx head, pan head, steel, zinc coated	M1024620
7	Module frame Back Hatch, F-CU5	M1012014
8	Power Board Air Filter, F-CU5(P)	M1016473
9	Scotchmate SJ-3526 D16	M1016475
10	MF-DF Hook, F-CU5(P)	M1014449
11	Foot Bumpon SJ-5632, F-CU5(P)	M1016471
12	NMF Module frame Bottom	M1012006
13	Module frame Module Base, F-CU5	M1012011
14	Module frame EMC-Casing 2, F-CU5(P)	M1018747
15	NMF MF Connection Flex board	M1022878
16	FEMALE SCREW LOCK, THREAD IN UNC4-40, THREAD OUT M3	640625
17	Fan Unit, F-CU5(P), Spare Par	M1028510
18	F-CU5 Power Board	M1021150
19	Module frame EMC-Casing 1, F-CU5(P)	M1018745
20	NMF module mother board	M1017298
21	Module frame PSM Option Mounting, F-CU5P	M1012016

Item	**Description**	**Order no.**
22	SCREW, screw for plastic, x12mm, WN1452, torx head, pan head, steel, zinc, SCREW-PT, PAN-HEAD, TORX, 3.0x12mm, ST-ZN, WN1452	628729
23	PSM Connection Flex Board Unit, F-CU5P	M1024805
24	NMF DFI board	M1022655
25	SCREW, M3x8mm, WN1452, torx head, pan head, steel, zinc coated	M1024618
26	NMF MF ECG sync connector flex board	M1022268
27	Module frame PSM Option Cover, F-CU5	M1014433
28	NMF MF EMBC shielding flex board	M1028023

2.2 Central Processor Unit for F-CU5, F-CPU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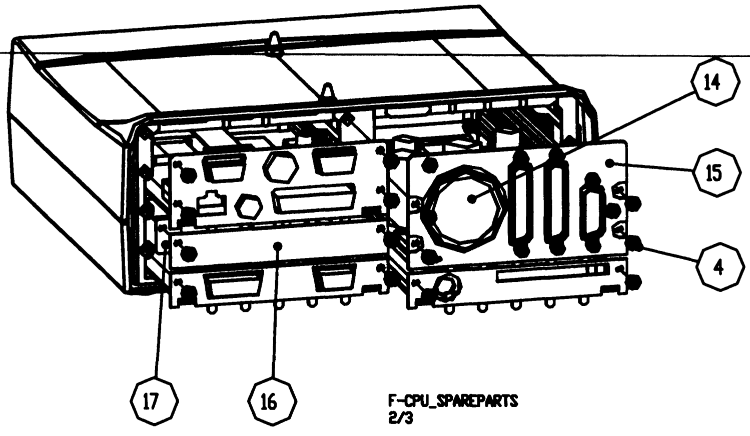
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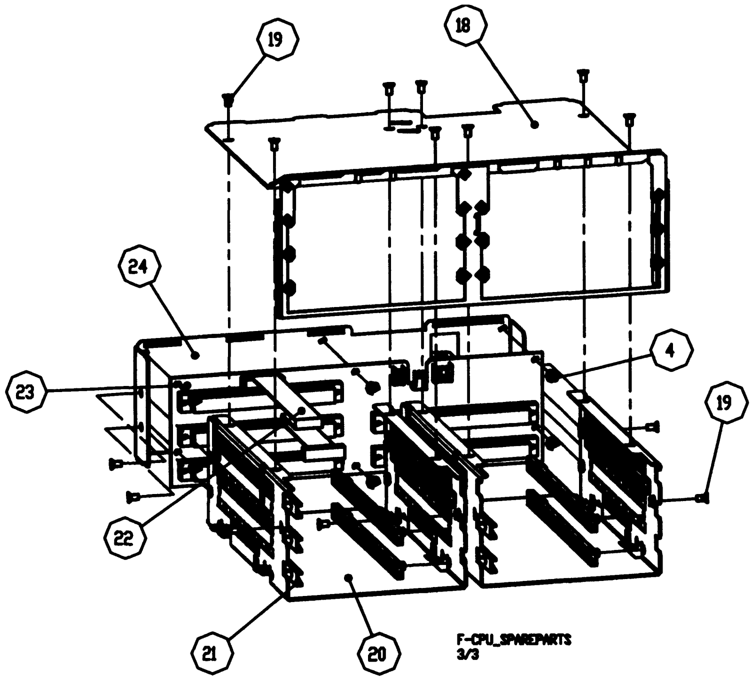
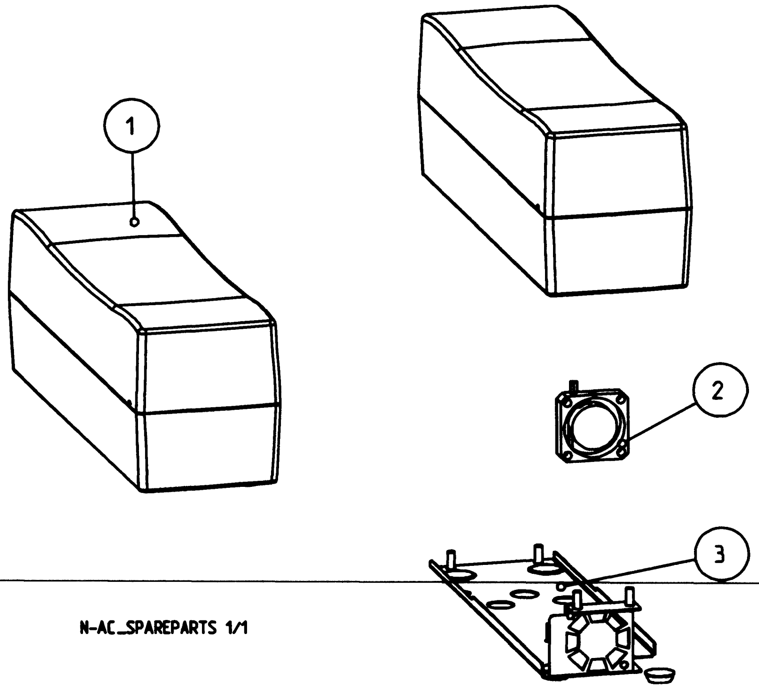


Item	**Description**	**Order no.**
1	Top Cover, F-CPU	M1012020
2	MF-DF Positioning Cone, F-CPU	M1014451
3	CPU battery cable, F-CU5	M1015773
4	SCREW, machine, M3x6mm, DIN6900-3, torx head, pan head, steel, zinc coated	M1024616
5	LOUDSPEAKER UNIT, F-CM1	896109
6	SCREW, thread forming, M3x8mm, WN1452, torx head, pan head, steel, zinc coated	M1024618
7	Speaker Shield, F-CPU	M1012029
8	Bottom Cover, F-CPU	M1012018
9	SCREW, machine, M4x40mm, DIN965, torx head, flat countersunk head, steel, zinc coated	M1024626
10	RUBBER FOOT, 12.7mm X 3.5mm, ROUND	65141
11	Dis Connector Unit, F-CPU	M1028506
12	BATTERY, 6V, 1.2Ah, rechargeable	17006
13	Battery Spacer, F-CPU	M1014458
14	Fan Filter	M1014462
15	F-CPU Power Board	M1021149
16	CONNECTOR PLATE 1, BLANK/NARROW	885389

Item	Description	Order no.
17	EMC-LEVY 2 B-DHIGH/B-DVGA	885398
18	EMC-Casing Cover, F-CPU	M1012026
19	SCREW, machine, M3x6mm, DIN965, torx head, flat countersunk head, steel, zinc coated	M1024613
20	EMC-Casing Frame, F-CPU	M1012024
21	Snap-in card guide, Nylon 6/6	M1020381
22	UPI-DIS-NMF Cable	M1020572
23	NMF CPU motherboard	M1014605
24	EMC-Casing Front Plate, F-CPU	M1014431

2.3 F-CU5 Power Unit, N-AC



Item	Description	Order no.
1	S/5 FCU5 Power Unit, N-AC	N-AC..00
2	N-AC Fan Unit, Spare Part	M1028505
3	Fan Plate Set	M1033982

3 8-Module Frame, F-CU8

NOTE: In case there are more than one spare part order number for the same item: check the revision or possible adaptation of the part that correspond your device. In 'Replaced by' column you find the replacing order number for a spare part that is not available anymore.

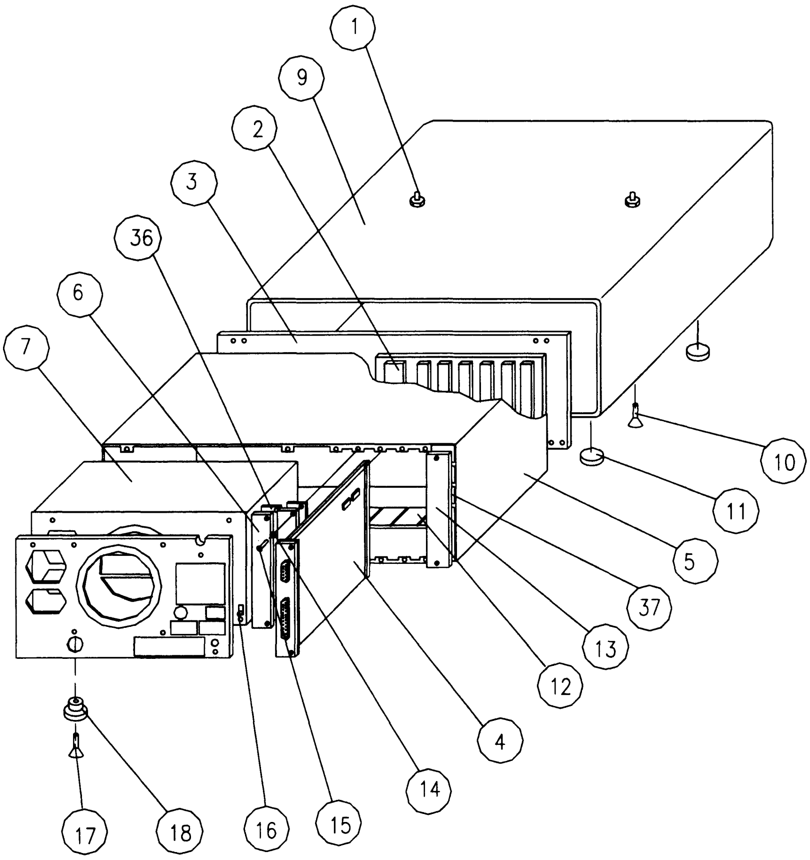


Figure 1 **Exploded view of the Central Unit F-CU8 (rev.03-09)**

3.1 8-Module Frame, F-CU8, rev.03-09

Item	Description	Order no.	Replaced by
1	Bronze tap for display screen tray	879476	
2	CPU mother board, AM/CCM	891585	
3	Module mother board, AM/CCM	882954	
4	UPI board, AM/CCM	890356	
4	UPI4NET Board	B-UPI4NET	
5	Metal box, F-CU8	882501	
7	Power supply unit for AM (-28)	884592	
7	Power supply unit for AM (-31)	884593	

Item	Description	Order no.	Replaced by
7	Power supply unit for AM/CCM (-22)	884591	
9	Frame housing, F-CU8	898314	
10	Cross cylinder head screw M5x8	61516	
11	Rubber foot 22x10mm	65144	
12	Rail for PC boards	879257	
13	Connector plate, blank/narrow	885389	
13	Connector plate, blank/wide	885394	
14	Shake proof washer m3.2	63611	
15	Cross cylinder head screw M3x8	61722	
16	Service Reset Switch, AM/CCM	52090	
17	Cross recess screw M6x30	61673	
18	Support plate for 61673	879502	
36	Grounding plate, blank/narrow	885398	
37	Grounding plate, blank/wide	885404	

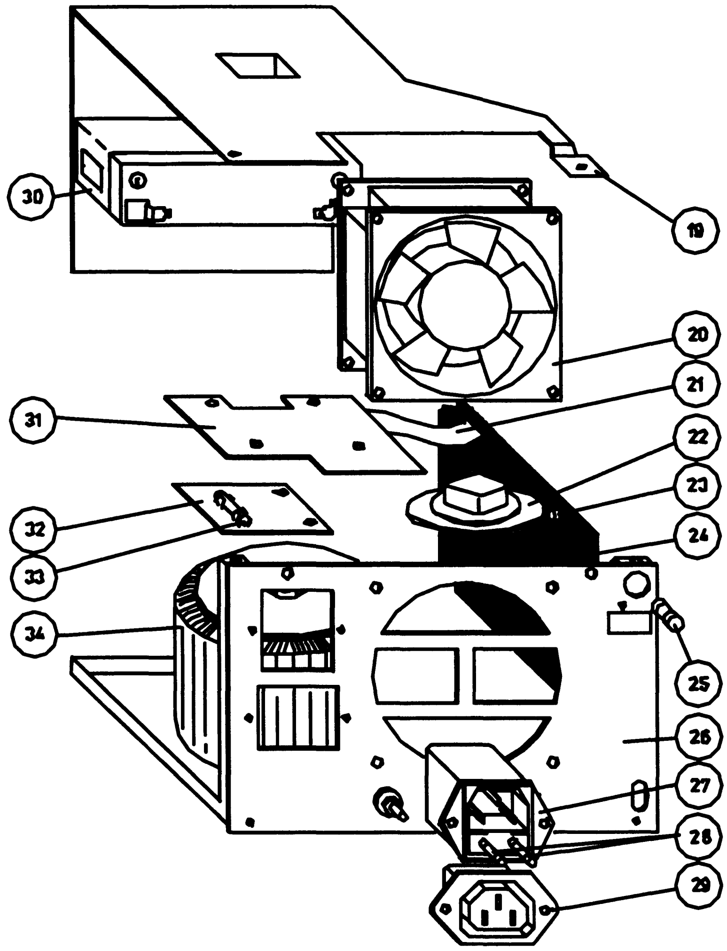


Figure 2 **Exploded view of the Power Supply Unit, F-CU8 (rev.03 ...09)**

Item	**Description**	**Order no.**	**Replaced by**
19	Power supply unit top cover, AM/CCM	882336	
20	Fan, AM/CCM	880049	
~~21~~	~~Ribbon cable (Pwr supply-Pwr logic)~~	~~882520~~	
22	Loudspeaker, AM/CCM	882509	
23	Fuse Miniature 2AF	51063	
24	Power supply board, AS/3 AM	885334	
25	Fuse T10A, 5x20mm, 250V	51137	
26	Power supply unit chassis, AM/CCM	882337	
27	Appliance socket w. filter, 4A	540140	
28	Fuse T3.15A, 5X20mm, (for 220-240)	51119	
28	Fuse T6.3A, 5x20mm, 250V	51128	
28	Fuse 5A, 5x20mm, 125V, UL/CSA	511382	

Item	**Description**	**Order no.**	**Replaced by**
29	Connector-appliance,chass.6A/250V, UL, CSA, VDE	54027	
30	Lead acid battery, 6V, 1.2Ah	17006	
31	Power logic board, AM/CCM	882508	
32	Triac board, AM/CCM	887364	
33	Fuse T2.5A, 5X20mm, 250V	51118	
33	FuseT2.5A,5x20mm,250V CSA/UL approved	511181	
34	Mains transformer, 110-120V	26138	
34	Mains transformer, 220-240V	26137	
34	Mains transformer, 100-105V	26139	

3.2 8-Module Frame, F-CU8, rev.10

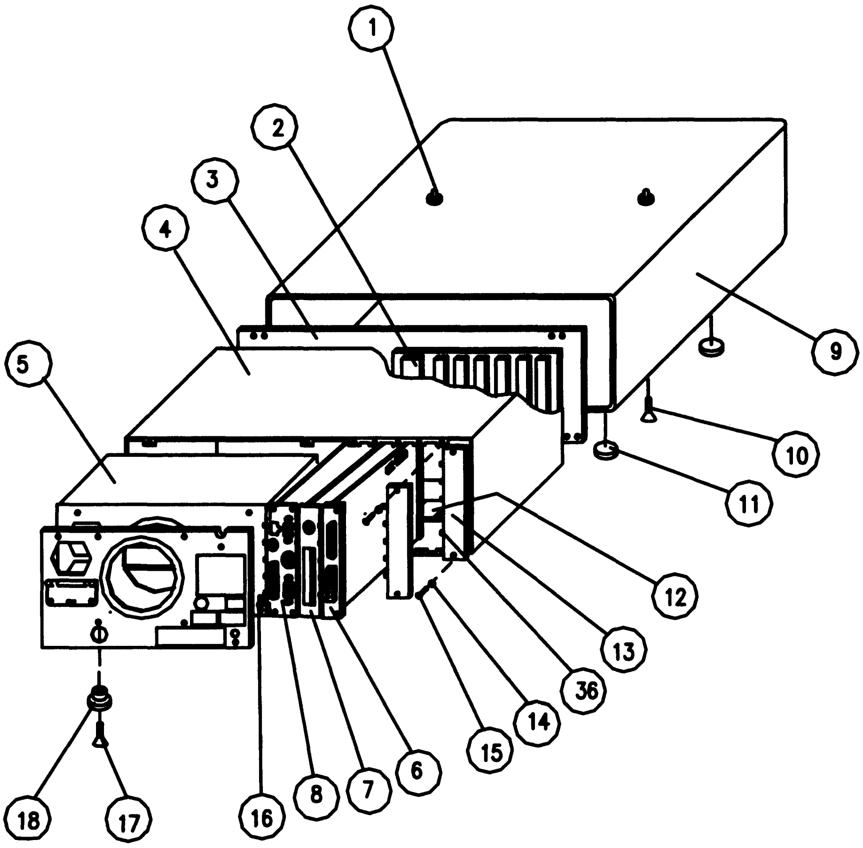


Figure 3 **Exploded view of the Central Unit F-CU8 (rev.10)**

Item	Description	Order no.	Replaced by
1	Bronze tap for display screen tray	879476	
~~2~~	~~CPU mother board, AM/CCM~~	~~891585~~	
3	Module mother board, AM/CCM	882954	
4	Metal box, F-CU8	882501	
5	Power supply unit for F-CU8 220-240V	M1028721	
5	Power supply unit for F-CU8 110-120V	M1028720	
5	Power supply unit for F-CU8 100V	M1005001	
6	Display controller board B-DISPX	B-DISPX	
7	CPU board, B-CPU5	B-CPU5	
8	UPINET Board, B-UPI4NET	B-UPI4NET	
9	Frame housing, F-CU8	898314	

Item	Description	Order no.	Replaced by
10	Cross cylinder head screw M5x8	61516	
11	Rubber foot 22x10mm	65144	
12	Rail for PC boards	879257	
13	Connector plate, blank/narrow	885389	
13	Connector plate, blank/wide	885394	
14	Shake proof washer m3.2	63611	
15	Cross cylinder head screw M3x8	61722	
16	Service Reset Switch, AM/CCM	52090	
17	Cross recess screw M6x30	61673	
18	Support plate for 61673	879502	
36	Grounding plate, blank/narrow	885398	
36	Grounding plate, blank/wide	885404	

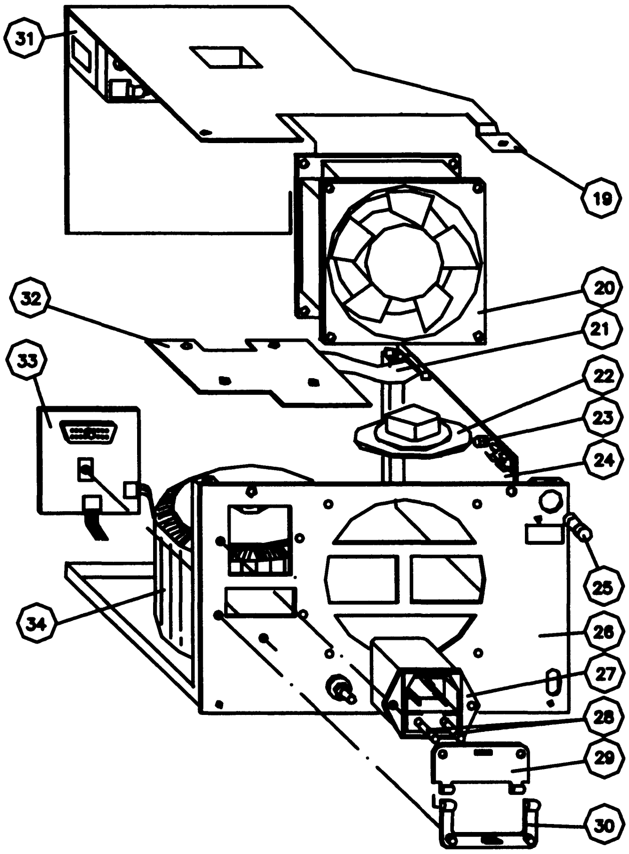


Figure 4 **Exploded view of the Power Supply Unit, F-CU8 (rev.10)**

Item	**Description**	**Order no.**	**Replaced by**
19	Cover, F-CU8 rev.10 Power Unit	M1014739	
20	Fan, AM/CCM	880049	
21	Ribbon cable (Pwr supply-Pwr logic)	882520	
~~22~~	~~Loudspeaker, AM/CCM~~	~~882509~~	
23	Fuse Miniature 2AF	51063	
24	Power board, F-CU8 rev.10-	M1010681	
25	Fuse T10A, 5x20mm, 250V	51137	
26	Body, F-CU8 rev.10 Power Unit	M1028737	
27	Appliance socket w. filter, 4A	540140	
28	Fuse T2.5A, 5X20mm, for Power Unit 220-240	511181	
28	Fuse 5A, 5x20mm, 125V, UL/CSA for 100V, 110-120V	511382	
29	Shutter plate	M1015167	

Item	**Description**	**Order no.**	**Replaced by**
30	Body of shutter	M1015169	
31	Lead acid battery, 6V, 1.2Ah	17006	
32	Power logic board, AM/CCM	882508	
33	Battery Switch Board	M1004931	
34	Mains transformer, 230V	M1007982	
34	Mains transformer, 115V	M1014489	
34	Mains transformer, 100-105V, 160 VA	M1014491	

4 Displays

4.1 15" Video Display, D-VMC15

Item	Description	Order no.
-	Facia assembly, D-VMC15	8001566
-	Cover assembly, D-VMC15	8001567
-	Washer tube fixing, D-VMC15	8001568
-	Mains cable, D-VMC15	8001569
-	Clip retaining IEC inlet, D-VMC15	8001570
-	Video lead, D-VMC15	8001571
-	Bracket assembly rear unit, D-VMC15	8001572

4.2 15" Video Display, D-VNC15

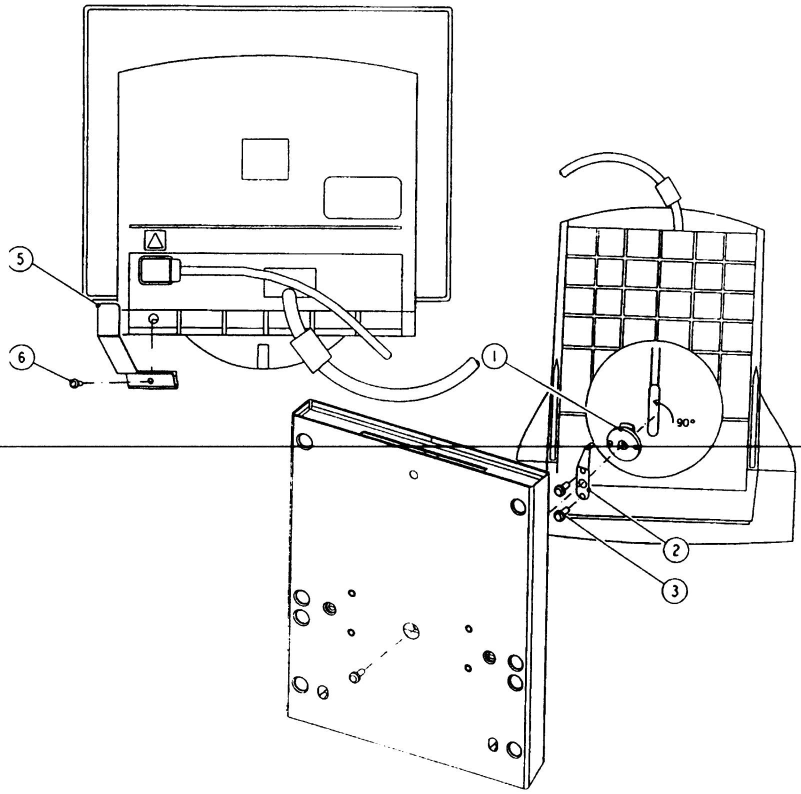


Figure 5 **Exploded view, D-VNC15**

Item	**Description**	**Order no.**	**Replaced by**
1	Locking washer, D-VNC15 (rev.00-02)	889164	
2	Motion limiter for 889164	889165	
3	Cross cylinder head screw M6x16	61775	
5	Power cord guard, D-VNC15 (rev.00-02)	889704	
6	Cross cylinder head screw M3x8	61722	

4.3 17" Video Display, D-VHC17

4.3.1 17" Video Display, D-VHC17, rev. 00

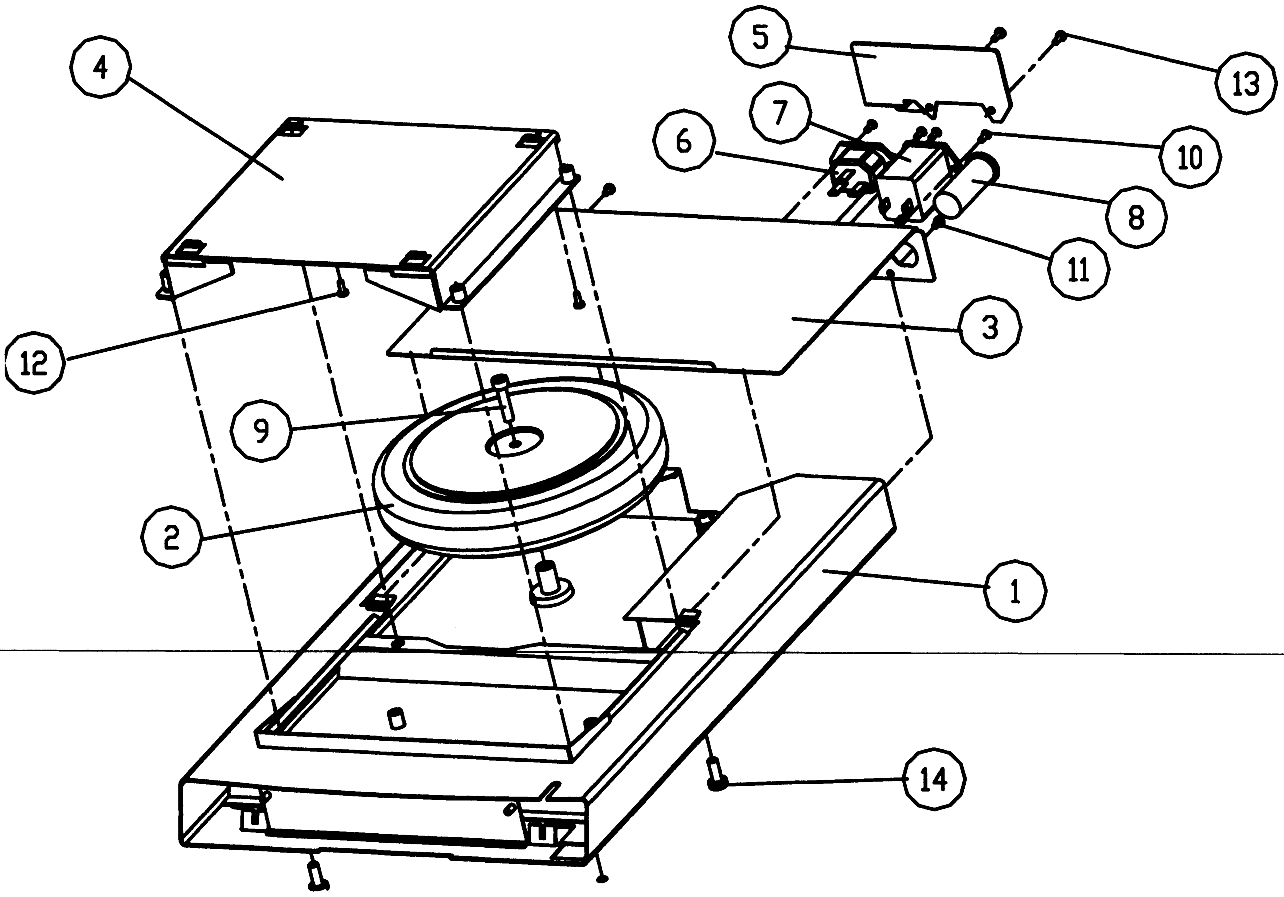


Figure 6 Exploded view, Video Display, D-VHC17

Item	Description	Order no.	Replaced by
1	Display tray, D-VHC17	891978	
2	Mains transformer, 100-120V	26108	
2	Mains transformer, 220-240V	26143	
3	Display tray cover, D-VHC17	892396	
4	Display bracket, D-VHC17	891979	
5	Power cord guard, D-VHC17	892791	
6	Connector-appliance,chass.6A/250V, UL, CSA, VDE	54027	
7	Appliance socket w. filter, 4A	540140	
8	Fuse holder, type FIZ, IP40	511792	
9	Hexagon cylinder head screw M6x25	61923	
10	Cross cylinder head screw M3x6	61621	
11	Cross cylinder-head screw M3x6	61721	
12	Cross cylinder head screw M3x8	61722	
13	Cross cylinder head screw M3x12	61736	
14	Cross cylinder head screw M6x16	61775	

Note: The display tray can fitted with a blank command board assembly in case the display is used as a secondary display. The blank command board assembly does not contain the ON/STBY -switch.

4.3.2 17" Video Display, D-VHC17, rev. 02

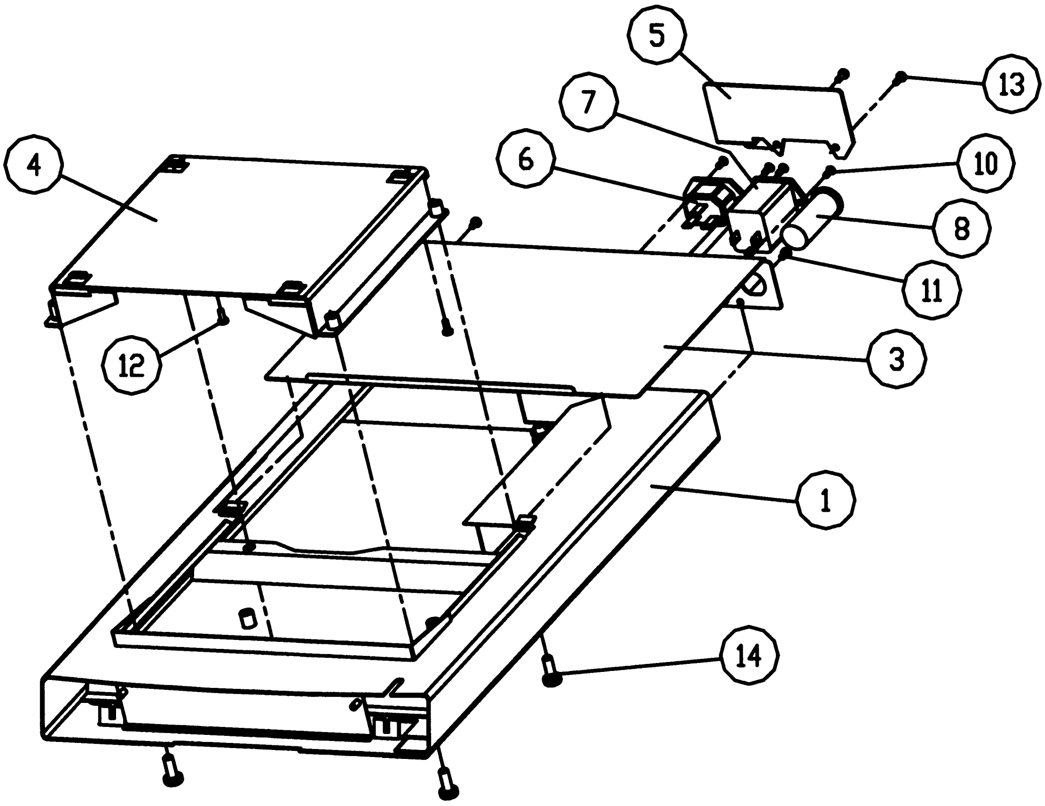


Figure 7 Exploded view, Video Display, D-VHC17, rev.02

Item	Description	Order no.	Replaced by
-	Fuse T3.15A (for 220-240V)	*51119	
-	Fuse 5A slow (for 100-120V)	*511382	
~~-~~	~~Fuse T2.5A~~	~~*51118~~	
-	Blank command board assembly	893723 [1)]	
1	Display tray, D-VHC17	891978	
3	Display tray cover, D-VHC17	892396	
4	Display bracket, D-VHC17	891979	
5	Power cord guard, D-VHC17	892791	
6	Display power outlet	54027	
7	Mains power receptacle	540140	
8	Fuse holder	511792	
10	Cross cylinder head screw M3x6	61621	

Item	Description	Order no.	Replaced by
12	Cross cylinder head screw M3x8	61722	
13	Cross cylinder head screw M3x12	61736	
14	Cross cylinder head screw M6x16	61775	

4.3.3 17" Video Display, D-VHC17, rev. 03

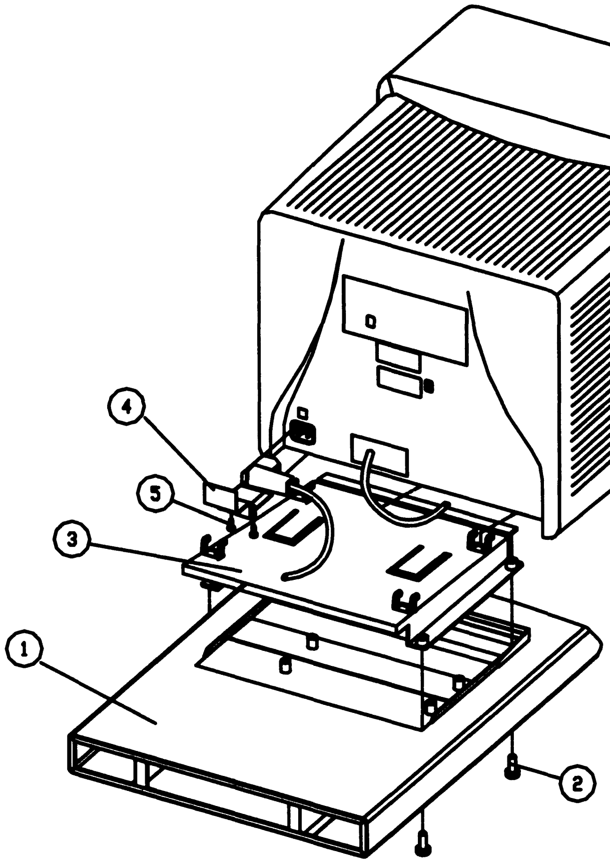


Figure 8 Exploded view, Video Display, D-VHC17, rev. 03

Item	Description	Order no.	Replaced by
1	Display tray, D-VHC17	8001972	
2	Cross cylinder head screw M6x16	61775	
3	Display adapter	8003085	
4	Strain relief, D-VHC17Rev. 03	8003089	
5	PT screw M3x8	628712	

4.4 21" Video Display, D-VSC21, rev. 00, 01, 02

No spare parts available.

4.5 LCD Display, D-LCC10, rev. 03, 04

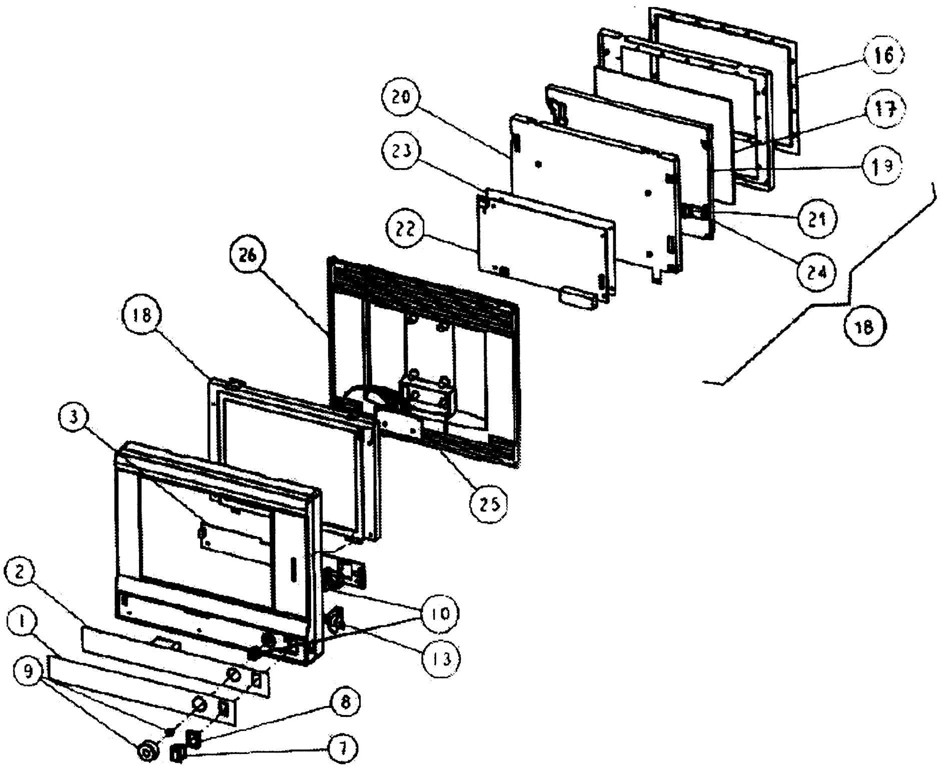


Figure 9 **Exploded view, LCD Display, D-LCC10, rev. 03, 04**

LCD Display, D-LCC10 rev. 03, 04 front

Item	Description	Order no.	Replaced by
1	Front Panel sticker, NL;D-LCC10(rev.02-03),K-VHC14,F-CM/REC(rev.00-02)	886043	
1	Front Panel sticker, DA; D-LCC10 (rev.04), K-ANE (rev.00)	892197	893075
1	Front Panel sticker, DE; D-LCC10 (rev.04), K-ANE (rev.00)	891664	893072
1	Front Panel sticker, DE; D-LCC10(rev.02-03),K-VHC14,F-CM/REC(rev.00-02)	885879	
1	Front Panel sticker, EN; D-LCC10 (rev.04), K-ANE (rev.00)	891663	893069
1	Front Panel sticker, EN; D-LCC10(rev.02-03), K-VHC14 (rev.02),F-CM/REC(rev.00-02)	885878	
1	Front Panel sticker, ES; D-LCC10 (rev.04), K-ANE (rev.00)	891667	893073
1	Front Panel sticker, ES; D-LCC10(rev.02-03),K-VHC14,F-CM/REC(rev.00-02)	886272	
1	Front Panel sticker, FI; D-LCC10 (rev.04), K-ANE (rev.00)	891669	893070
1	Front Panel sticker, FI; D-LCC10(rev.02-03),K-VHC14,F-CM/REC(rev.00-02)	888860	

Item	Description	Order no.	Replaced by
1	Front Panel sticker, FR; D-LCC10 (rev.04), K-ANE (rev.00)	891665	893076
1	Front Panel sticker, FR; D-LCC10(rev.02-03),K-VHC14,F-CM/REC(rev.00-02)	885880	
1	Front Panel sticker, IT; D-LCC10 (rev.04), K-ANE (rev.00)	891668	893078
1	Front Panel sticker, IT; D-LCC10(rev.02-03),K-VHC14,F-CM/REC(rev.00-02)	886751	
1	Front Panel sticker, JA; D-LCC10 (rev.04), K-ANE (rev.00)	892080	893071
1	Front Panel sticker, JA; D-LCC10(rev.03),K-VHC14, F-CM/REC(rev.01-02)	888306	
1	Front Panel sticker, NL; D-LCC10 (rev.04), K-ANE (rev.00)	891666	893077
1	Front Panel sticker, SV; D-LCC10 (rev.04), K-ANE (rev.00)	891670	893074
1	Front Panel sticker, SV; D-LCC10(rev.02-03),K-VHC14,F-CM/REC(rev.00-02)	885946	
2	Membrane keypad, K-VHC14	879373	
3	Command board PCB	886821	891410
3	Command board PCB, D-LCC10A/C/W	894173	883022
7	ON/STBY switch	879871	
8	ON/STBY switch protector	881431	
9	ComWheel cover and spring	879191	
10	Rotary wheel	879872	
13	Internal cable (Personal Computer)	881826	
18	LCD display unit, complete	887737	895098
18	LCD display unit, complete	887737	894931
18	LCD display unit, complete	887737	895104
25	D-LCC10 unit cable, (rev.03)	888222	
26	Rear cover, D-LCC10 (rev.03)	889367	

LCD Display, D-LCC10, rev. 03, 04 back

Item	Descripition	Order no.	Replaced by
16	LCD display gasket	890123	
17	Display window	572787	
18	LCD display unit, complete	887737	895098
18	LCD display unit, complete	887737	894931
18	LCD display unit, complete	887737	895104
19	LCD display, VGA 10.4in.	572784	894931
19	LCD display, VGA 10.4in.	572784	895098
19	LCD display, VGA 10.4in.	572784	895104

Item	Descripition	Order no.	Replaced by
20	Adapter unit	887125	
21	Flat cable	71409	
22	Adapter board	887840	
23	Insulation plate	887739	
24	Connector board, LCD	888220	

4.6 LCD Display, D-LCC10A/W

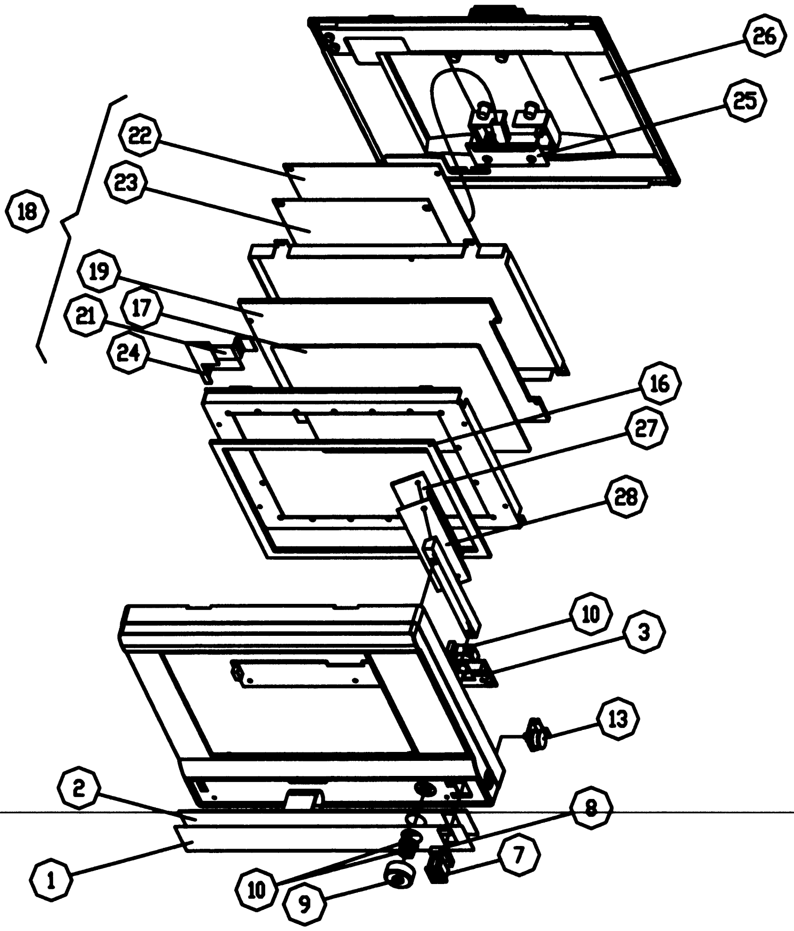


Figure 10 Exploded view, LCD Display D-LCC10A

Item	Description	Order no.	Replaced by
1	Front Panel sticker, DA; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893075	8000168
1	Front Panel sticker, DA; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893075	898338
1	Front Panel sticker, DA; D-LCC10W (rev.01); S/5	898338	

Item	**Description**	**Order no.**	**Replaced by**
1	Front Panel sticker, DE; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893072	8000159
1	Front Panel sticker, DE; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893072	898329
1	Front Panel sticker, DE; D-LCC10W (rev.01); S/5	898329	
1	Front Panel sticker, EN; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893069	8000158
1	Front Panel sticker, EN; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893069	898328
1	Front Panel sticker, EN; D-LCC10W (rev.01); S/5	898328	
1	Front Panel sticker; ES; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893073	8000162
1	Front Panel sticker; ES; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893073	898332
1	Front Panel sticker, ES; D-LCC10W (rev.01); S/5	898332	
1	Front Panel sticker, FI; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893070	8000165
1	Front Panel sticker, FI; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893070	898335
1	Front Panel sticker, FI; D-LCC10W (rev.01); S/5	898335	
1	Front Panel sticker, FR; D-L-CC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893076	8000160
1	Front Panel sticker, FR; D-L-CC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893076	898330
1	Front Panel sticker, FR; D-LCC10W (rev.01); S/5	898330	
1	Front Panel sticker, IT; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893078	8000163
1	Front Panel sticker, IT; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893078	898333
1	Front Panel sticker, IT; D-LCC10W (rev.01); S/5	898333	
1	Front Panel sticker, JA; D-LCC10W (rev.01); S/5	898339	
1	Front Panel sticker, NL; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893077	8000161
1	Front Panel sticker, NL; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893077	898331
1	Front Panel sticker, NL; D-LCC10W (rev.01); S/5	898331	

Item	Description	Order no.	Replaced by
1	Front Panel sticker, NO; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893550	8000167
1	Front Panel sticker, NO; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893550	898337
1	Front Panel sticker, NO; D-LCC10W (rev.01); S/5	898337	
1	Front Panel sticker, PT; D-LCC10W (rev.01); S/5	898334	
1	Front Panel sticker, SV; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC v(rev.03-04)	893074	8000166
1	Front Panel sticker, SV; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC v(rev.03-04)	893074	898336
1	Front Panel sticker, SV; D-LCC10W (rev.01); S/5	898336	
2	Membrane keypad, K-VHC14	879373	
3	Command board PCB, D-LCC10A/C/W	894173	883022
7	ON/STBY switch	879871	
8	ON/STBY switch protector	881431	
9	ComWheel cover and spring	879191	
10	Rotary wheel	879872	
10	Rotary wheel	879872	
13	K-ARK connector with cable	889370	
16	LCD display gasket	890123	
17	LCD display shield	892677	
18	LCD display unit, complete	891571	
19	LCD display, TFT, VGA 10.4in.	572788	
21	Inverter cable	891970	
22	Adapter board	892424	
23	Insulation plate for 892424	891975	
24	Connector board (LCD), AM/CM	892421	
25	LCD unit cable	893247	
26	Rear cover, D-LCC10A/C	892375	
26	Rear cover, D-LCC10W	893699	
27	Display-inverter,12V 2x6mA for572793	572794	
27	12V inverter for LCD display 572788	572789	572794
28	LCD display shield	892677	

4.7 LCD Display, D-LCC12A

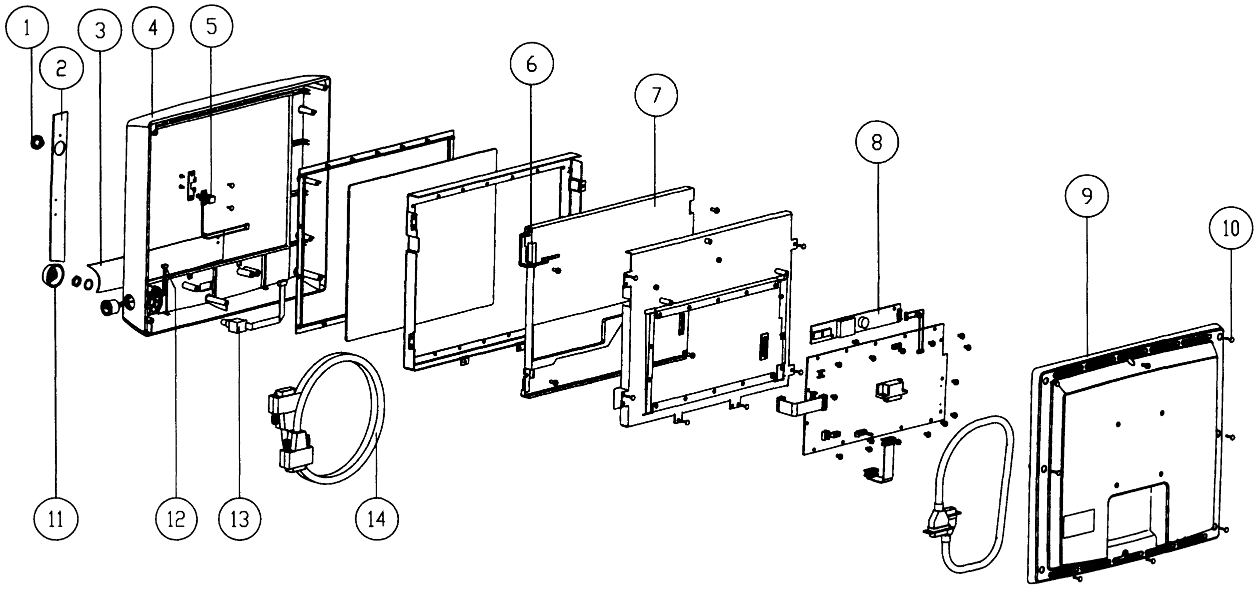


Figure 11 Exploded view, LCD Display D-LCC12A

4.7.1 LCD Display, D-LCC12A, rev. 00

Item	Description	Order no.	Replaced by
1	ON/STBY-switch cap	8001436	
2	LED board	M1021700	
3	Keyboard	M1021697	
4	Front cover, D-LCC12A	M1021703	
5	ON/STBY-switch	M1021694	
6	Backlight for LCD display 902673	M1001013	
~~7~~	~~LCD display~~	~~902673~~	
8	Inverter for LCD display 902673	902674	
9	Rear cover, D-LCC12A	M1021705	
10	Screw PT K30x10	628728	
11	ComWheel cover	898794	
12	ARK connector with cable	M1021696	
13	ComWheel	M1021691	
14	LCD interface cable 3m, D-LCC12A	M1021695	

4.7.2 LCD Display, D-LCC12A, rev.01

Item	**Description**	**Order no.**	**Replaced by**
1	ON/STBY-switch cap	8001436	
2	LED board	M1021700	
3	Keyboard	M1021697	
4	Front cover, D-LCC12A	M1021703	
5	ON/STBY-switch	M1021694	
6	Backlight for LCD display M1012542	M1014385	
7	LCD display	M1012542	
8	Inverter for LCD display M1012542	M1013813	
9	Rear cover, D-LCC12A	M1021705	
10	Screw PT K30x10	628728	
11	ComWheel cover	898794	
12	ARK connector with cable	M1021696	
13	ComWheel	M1021691	
14	LCD interface cable 10m, D-LCC12A rev.01	M1035180	

4.7.3 Front panel stickers for D-LCC12A, rev 00...01

Item	Description	Order no.	Replaced by
	Front Panel Sticker, DA	8504288	
	Front Panel Sticker, DE	8504279	
	Front Panel Sticker, EN	8504278	
	Front Panel Sticker, ES	8504282	
	Front Panel Sticker, FI	8504285	
	Front Panel Sticker, FR	8504280	
	Front Panel Sticker, IT	8504283	
	Front Panel Sticker, JA	M1004974	
	Front Panel Sticker, NL	8504281	
	Front Panel Sticker, NO	8504287	
	Front Panel Sticker, PL	M1004975	
	Front Panel Sticker, PT	8504284	
	Front Panel Sticker, SV	8504286	
	Front Panel Sticker, Blank (vertical)	8504276	

4.8 LCD Display, D-LCC15

Item	Description	Order no.	Replaced by
-	Back light, D-LCC15 rev. 01	8001592	
-	Back light, D-LCC15 rev. 02-03	M1006780	
-	Video Cable, D-LCC15	8001593	
-	Video Cable for D-LCC15 Rev.03, black, 3m	909293	
-	Power, D-LCC15	8001595	
-	Display Cover Assembly for D-LCC15	8002005	M1006445 M1006449
-	Display Stand Assembly for D-LCC15	8002006	
-	Anti Glare Filter for D-LCC15	8002007	
-	Front cover, w stickers	M1006445	
-	Rear cover, w stickers	M1006449	

4.9 LCD Display, D-LCC17

Item	Description	Order no.
	VGA Video Cable, 3 m	8001593
	Power Adapter for D-LCC17	M1009746

4.10 LCD Display, D-LCC19

Item	Description	Order no.
-	VGA Video Cable, 3m	8001593
-	Power Adapter for D-LCC19	M1002495

4.11 Plasma Display, D-MMP42

No spare parts available.

4.12 Plasma Display, D-MMP43

No spare parts available.

5 Extension frame

5.1 Extension Frame, F-EXT4, rev. 01

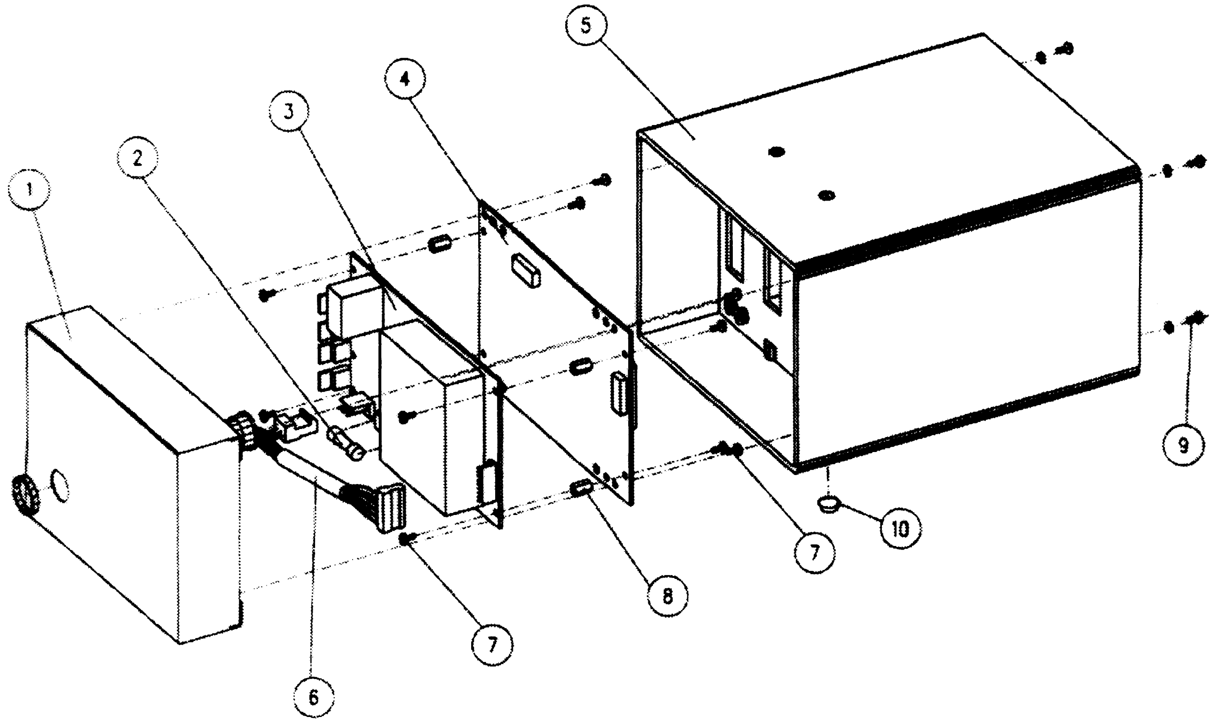


Figure 12 Exploded view of F-EXT4, rev. 01

Table 1 Extension Frame, F-EXT4, rev. 01 spare parts

Item	Description	Order no.	Replaced by
1	Rear frame, F-EXT4	881234	892379
1	Rear frame, F-EXT4	892379	898316
2	Fuse T2.5A, 5X20mm, 250V	51118	
3	Power supply board, F-EXT4 (rev.01)	884840	
4	Module mother board, F-EXT4 (rev.01-02)	884839	
5	Frame with Rubber Pads (rev.01)	881233	893113
5	Frame with rubber pads (rev.02)	893113	898317
6	Internal connector cable, F-EXT4	884838	
7	Cross cylinder-head screw M3x6	61721	
7	Cross cylinder-head screw M3x6	61721	
8	Bushing 6	40455	
9	Cross cylinder head screw M3x12	61736	

Item	Description	Order no.	Replaced by
10	Rubber foot 22x10mm	65144	
13	Dust filter, 53 mm	874594	
14	Protection mesh	58201	
15	Cross cylinder head screw M3x18 FZB DIN7985	61739	
16	Slotted recess screw M3x6	61223	

5.2 Extension Frame, F-EXT4, rev. 02, 03

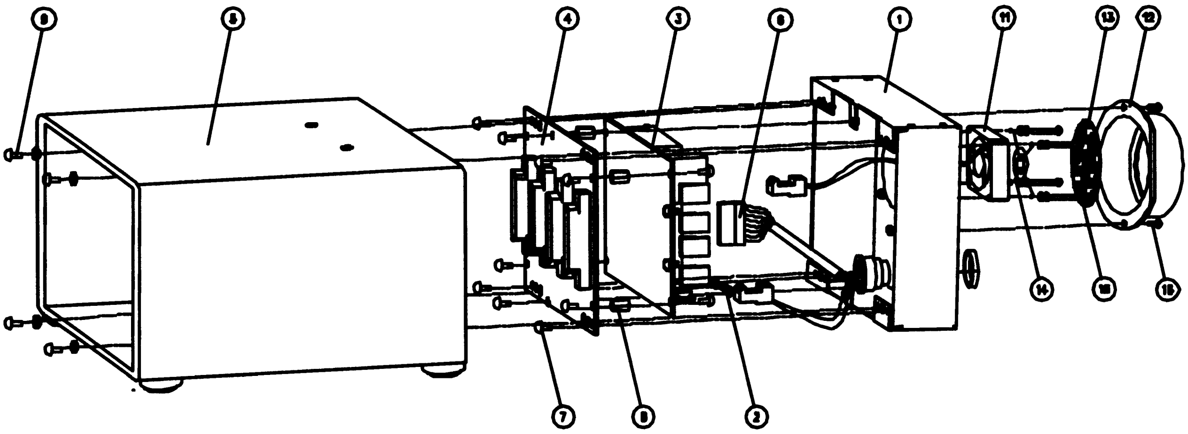


Figure 13 **Exploded view of F-EXT4, rev. 02, 03**

Table 2 **Extension Frame, F-EXT4, rev. 02, 03 spare parts**

Item	Description	Order no.	Replaced by
1	Power covering rev.03	898316	
1	Rear frame, F-EXT4	892379	898316
2	Fuse T2.5A, 5X20mm, 250V	51118	
3	Power supply board, F-EXT4	892378	
4	Module mother board, F-EXT4 (rev.01-02)	884839	
5	Frame housing, F-EXT4 (rev.03)	898317	
5	Frame with rubber pads (rev.02)	893113	898317
6	Internal connector cable, F-EXT4	884838	
7	Cross cylinder-head screw M3x6	61721	
8	Bushing	640455	
9	Cross cylinder head screw M3x12	61736	
11	Fan, F-EXT4	893141	
12	Fan cover, F-EXT4	892680	

Item	Description	Order no.	Replaced by
13	Dust filter, 53 mm	874594	
14	Protection mesh	58201	
15	Cross cylinder head screw M3x18 FZB DIN7985	61739	
16	Slotted recess screw M3x6	61223	

5.3 Extension Module, E-EXT rev. 00

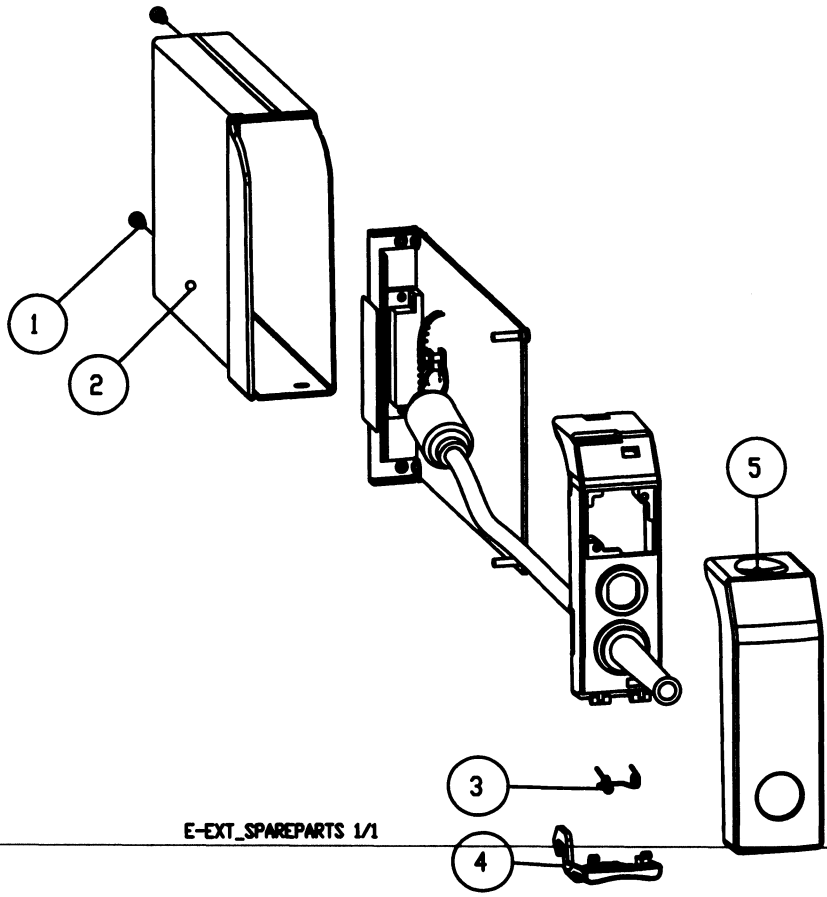


Table 3 **Extension Module, E-EXT, rev. 00 spare parts**

Item	Description	Order no.	Replaced by
1	SCREW, M3x8mm, DIN965, torx head, flat countersunk head, steel, zinc coated	606024	
2	Module Casing, Single	M1021035	
3	Torsion Spring	M1020935	
4	Latch	M1021039	
5	Front Cover, E-EXT	M1025710	

5.4 Extension Module, M-EXT, rev. 01, M-EXT, rev. 02

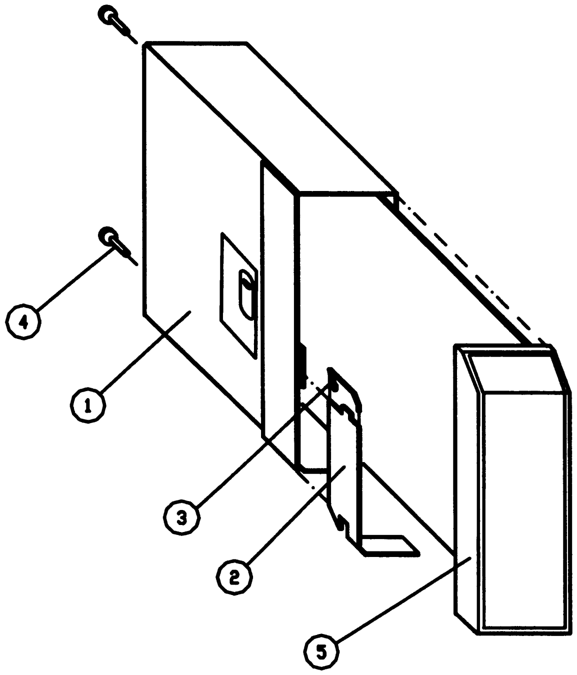


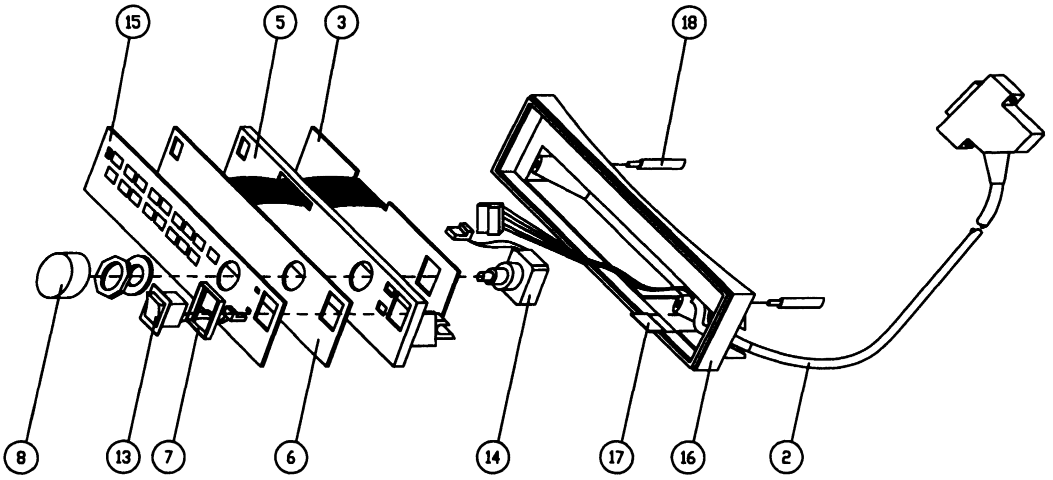
Table 4 **Extension Module, M-EXT, rev. 01, M-EXT, rev. 02 spare parts**

Item	Description	Order no.	Replaced by
1	Module box (single width)	886167	
2	Latch for module box	879181	
3	Spring pin	879182	
4	Cross recess screw M3x8 black	616215	
5	Front panel unit (M-EXT)	882080	
~~-~~	~~Front panel sticker for M-EXT (Rev. 01)~~	~~882085~~	~~8000212~~
-	Front panel sticker for M-EXT (Rev. 02)	8000212	

6 Command Board, K-ANE, K-ICU

Item numbers refer to the exploded view.

6.1 Command Board, K-ANE, K-ICU, rev. 00-02

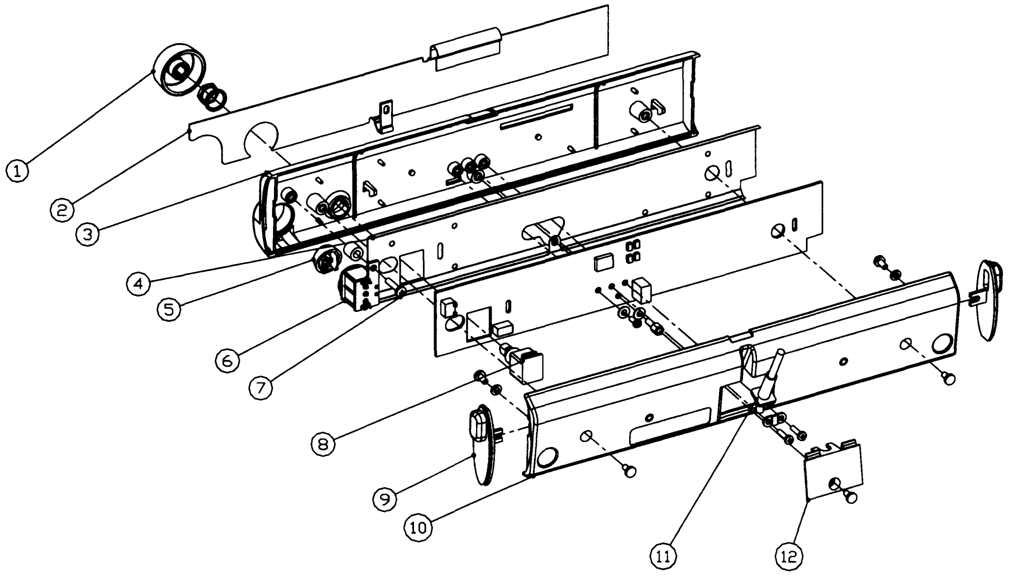


Item	Description	Order no.	Replaced by
2	Command board cable, K-ANE/ICU/BLANK	893945	
2	Command board cable, K-VHC14 (rev.02)	883229	893945
3	Command board PC board, K-ANE/ICU, D-LCC10	893943	
3	Command board PC board, K-VCH14, K-VNC15	883228	893943
5	Plastic front cover, K-ANE/ICU/BLANK (rev.01)	892812	
5	Plastic front cover, K-VHC14 (rev.02), K-VNC15	883178	892812
6	Membrane key pad, K-VHC14	879373	
7	ON/STBY switch protector	881431	
8	ComWheel; S/5	898794	
8	ComWheel cover and spring	879191	
13	ON/STBY switch	879871	
14	Rotary wheel	879872	
15	Front Panel sticker, DA; D-LCC10 (rev.04), K-ANE (rev.00)	892197	893075
15	Front Panel sticker, DA; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893075	8000168

Item	**Description**	**Order no.**	**Replaced by**
15	Front Panel sticker, DA; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893075	898338
15	Front Panel sticker, DA; K-ANE (rev.02); S/5	8000168	
15	Front Panel sticker, DE; D-LCC10 (rev.04), K-ANE (rev.00)	891664	893072
15	Front Panel sticker, DE; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893072	8000159
15	Front Panel sticker, DE; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893072	898329
15	Front Panel sticker; DE; K-ANE (rev.02); S/5	8000159	
15	Front Panel sticker, EN; D-LCC10 (rev.04), K-ANE (rev.00)	891663	893069
15	Front Panel sticker, EN; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893069	8000158
15	Front Panel sticker, EN; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893069	898328
15	Front Panel sticker, EN; K-ANE (rev.02); S/5	8000158	
15	Front Panel sticker, ES; D-LCC10 (rev.04), K-ANE (rev.00)	891667	893073
15	Front Panel sticker; ES; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893073	8000162
15	Front Panel sticker; ES; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893073	898332
15	Front Panel sticker, ES; K-ANE (rev.02); S/5	8000162	
15	Front Panel sticker, FI; D-LCC10 (rev.04), K-ANE (rev.00)	891669	893070
15	Front Panel sticker, FI; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893070	8000165
15	Front Panel sticker, FI; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893070	898335
15	Front Panel sticker, FI; K-ANE (rev.02); S/5	8000165	
15	Front Panel sticker, FR; D-LCC10 (rev.04), K-ANE (rev.00)	891665	893076
15	Front Panel sticker, FR; D-L-CC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893076	8000160
15	Front Panel sticker, FR; D-L-CC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893076	898330
15	Front Panel sticker, FR; K-ANE (rev.02); S/5	8000160	
15	Front Panel sticker, IT; D-LCC10 (rev.04), K-ANE (rev.00)	891668	893078
15	Front Panel sticker, IT; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893078	8000163

Item	Description	Order no.	Replaced by
15	Front Panel sticker, IT; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893078	898333
15	Front Panel sticker, IT; K-ANE (rev.02); S/5	8000163	
15	Front Panel sticker, JA; D-LCC10 (rev.04), K-ANE (rev.00)	892080	893071
15	Front Panel sticker, JA; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893071	8000692
15	Front Panel sticker, JA; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893071	898339
15	Front Panel sticker, JA; K-ANE (rev.02); S/5	8000692	
15	Front Panel sticker, NL; D-LCC10 (rev.04), K-ANE (rev.00)	891666	893077
15	Front Panel sticker, NL; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893077	8000161
15	Front Panel sticker, NL; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893077	898331
15	Front Panel sticker, NL; K-ANE (rev.02); S/5	8000161	
15	Front Panel sticker, NO; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893550	8000167
15	Front Panel sticker, NO; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC (rev.03-04)	893550	898337
15	Front Panel sticker, NO; K-ANE (rev.02); S/5	8000167	
15	Front Panel sticker, PT; K-ANE (rev.01), D-LCC10A (rev.00), F-CM/REC (rev.04)	895231	8000164
15	Front Panel sticker, PT; K-ANE (rev.01), D-LCC10A (rev.00), F-CM/REC (rev.04)	895231	898334
15	Front Panel sticker, PT; K-ANE (rev.02); S/5	8000164	
15	Front Panel sticker, SV; D-LCC10 (rev.04), K-ANE (rev.00)	891670	893074
15	Front Panel sticker, SV; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC v(rev.03-04)	893074	8000166
15	Front Panel sticker, SV; D-LCC10A/W (rev.00), K-ANE (rev.01), F-CM/REC v(rev.03-04)	893074	898336
15	Front Panel sticker, SV; K-ANE (rev.02); S/5	8000166	
16	Plastic rear cover, K-ANE/ICU/BLANK (rev.01)	892811	
16	Plastic rear cover, K-VHC14 (rev.02)	883177	892811
17	Insulation plate	883963	
18	Insul nylonpost,25x6.5,M3 male/female	640446	

6.2 Command Bar, K-ANEB, K-ICUB, rev.00



6.2.1 Command Bar, K-ANEB

Item	Description	Order no.	Replaced by
1	ComWheel; S/5	898794	
2	Membrane keypad, K-ANEB	898255	
3	Front cover, K-ANEB	897980	
4	EMC plate, K-ANEB	8000225	
5	Bushing	640453	
6	ON/STBY-switch, K-ANEB	8001395	
7	Command board PC board	898007	
8	Opto-encoder, rotary switch,16-positions,push button, metal shaft, 4inch ribbon cable and connector	113291	
9	Closing cover, K-ANEB, K-ICUB	897983	
10	Back cover, K-ANEB	897981	
11	Command bar cable, K-ANEB, K-ICUB	898283	
12	Cable plate, K-ANEB	897982	
13	Front Panel sticker, DA; K-ANEB; S/5	898093	
13	Front Panel sticker, DE; K-ANEB; S/5	898084	

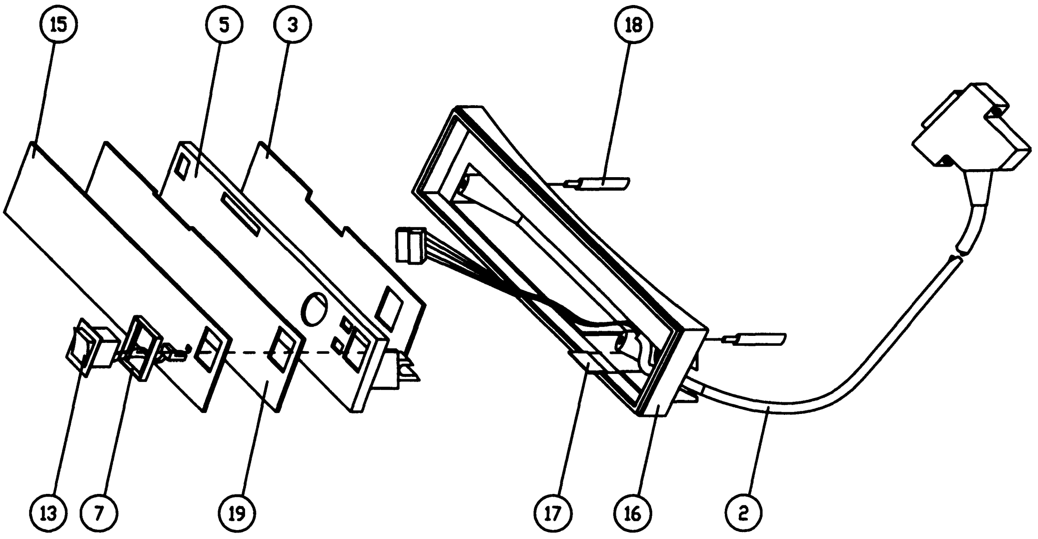
Item	Description	Order no.	Replaced by
13	Front Panel sticker, EN; K-ANEB; S/5	898083	
13	Front Panel sticker, ES; K-ANEB; S/5	898087	
13	Front Panel sticker, FI; K-ANEB; S/5	898090	
13	Front Panel sticker, FR; K-ANEB; S/5	898085	
13	Front Panel sticker, IT; K-ANEB; S/5	898088	
13	Front Panel sticker, JA; K-ANEB; S/5	898094	
13	Front Panel sticker, NL; K-ANEB; S/5	898086	
13	Front Panel sticker, NO; K-ANEB; S/5	898092	
13	Front Panel sticker, PT; K-ANEB; S/5	898089	
13	Front Panel sticker, SV; K-ANEB; S/5	898091	

6.2.2 Command Bar, K-ICUB

Item	Description	Order no.	Replaced by
1	ComWheel; S/5	898794	
2	Membrane keypad, K-ANEB	898255	
3	Front cover, K-ANEB	897980	
4	EMC plate, K-ANEB	8000225	
5	Bushing	640453	
6	ON/STBY-switch, K-ANEB	8001395	
7	Command board PC board	898007	
8	Opto-encoder, rotary switch,16-positions, push button, metal shaft, 4 inch ribbon cable and connector	113291	
9	Closing cover, K-ANEB, K-ICUB	897983	
10	Back cover, K-ANEB	897981	
11	Command bar cable, K-ANEB, K-ICUB	898283	
12	Cable plate, K-ANEB	897982	
13	Front Panel sticker, DA; K-ICUB; S/5	898105	
13	Front Panel sticker, DE; K-ICUB; S/5	898096	
13	Front Panel sticker, EN; K-ICUB; S/5	898095	
13	Front Panel sticker, ES; K-ICUB; S/5	898099	
13	Front Panel sticker, FI; K-ICUB; S/5	898102	
13	Front Panel sticker, FR; K-ICUB; S/5	898097	
13	Front Panel sticker, IT; K-ICUB; S/5	898100	

Item	Description	Order no.	Replaced by
13	Front Panel sticker, JA; K-ICUB; S/5	898106	
13	Front Panel sticker, NL; K-ICUB; S/5	898098	
13	Front Panel sticker, NO; K-ICUB; S/5	898104	
13	Front Panel sticker, PT; K-ICUB; S/5	898101	
13	Front Panel sticker, SV; K-ICUB; S/5	898103	

6.3 Blank Command Board, K-BLANK



6.3.1 Blank Command Board, K-BLANK, rev. 00

Item	Description	Order no.
2	Command board cable, K-VHC14 (Rev.02)	*(883229) Use 893945
3	Command board PC board, K-VCH14, K-VNC15	(883228) Use 893943
5	Plastic front cover, K-VHC14 (Rev. 02), K-VNC15	883178
7	ON/STBY switch protector	881431
13	ON/STBY switch	*879871
16	Plastic rear cover, K-VHC14 (Rev. 02)	883177
17	Insulation plate	883963
18	Bushing 25x6.5, M3	640446
19	Fitting plate, K-BLANK	892335

6.3.2 Blank Command Board, K-BLANK, rev. 01

Item	**Description**	**Order no.**
2	Command board cable, K-ANE/ICU/BLANK	*893945
3	Command board PC board, K-ANE/ICU, D-LCC10	*893943
5	Plastic front cover, K-ANE/ICU/BLANK (Rev. 01)	892812
16	Plastic rear cover, K-ANE/ICU /BLANK (Rev. 01)	892811

6.3.3 Blank Command Bar, K-BLANKB, rev. 00

Item numbers refer to exploded view of K-ANEB, K-ICUB

Item	**Description**	**Order no.**
3	Front cover, K-BLANKB	8001573
9	Closing cover, K-BLANK	8001954
10	Back cover, K-ANEB	897981
12	Cable plate, K-ANEB	897982